$40.00

TM 11-5821-248-35

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

DIRECT AND GENERAL SUPPORT AND DEPOT MAINTENANCE MANUAL

RADIO SET AN/ARC-102

Lachu to file
if applicable

HEADQUARTERS, DEPARTMENT OF THE ARMY

MAY 1964

AGO 8937A

WARNING:

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

Be careful when working on the low-voltage power supply module A5, the external power supply, and the dc line connections.

DON'T TAKE CHANCES!

EXTREMELY DANGEROUS VOLTAGES EXIST IN THE FOLLOWING CIRCUITS:

Single-Phase High-Voltage Power Supply Module, A13 ..... 1,500 volts dc
Three-Phase High-Voltage Power Supply Module, A7 .... 1,500 volts dc
27.5-Volt D-C High-Voltage Power Supply Module, A8 ..... 1,500 volts dc

CAUTION:

Do not make resistance measurements on the transistorized circuits of the equipment. Make voltage and resistance measurements only as specified. (See paragraph 6, chapter 4, before making any resistance measurements in the equipment.)

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

ORGANIZATION MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS LISTS
RADIO SET AN/ARC-102
FSN: 5821-050-8255

Headquarters, Department of the Army, Washington, D.C.
30 March 1973

(Current as of 1 December 1972)

Table of Contents

* This manual supersedes TM 11-5821-248-20P, 10 September 1964.

SECTION I
INTRODUCTION

1. Scope

This manual lists repair parts required for the performance of organizational maintenance of Radio Set AN/ARC-102.

2. General

This Repair Parts and Special Tools List is divided into the following sections:

a. Repair Parts List—Section II. A list of repair parts authorized at the organizational level for the performance of maintenance. Parts are listed in figure and item number sequence.

b. Special Tools List (Not Applicable).

c. Federal Stock Number and Reference Number Index (Not Applicable).

3. Explanation of Columns

The following provides an explanation of columns found in the tabular listing.

a. Source, Maintenance, and Recoverability Codes (SMR).

(1) *Source codes:* Codes entered in the first and second digit of the SMR CODES, which indicate the source for the listed items.

Code	*Explanation*
PA	Item procured and stocked for anticipated or known usage.
PB	Item procured and stocked for insurance purposes because essentiality dictates that a minimum quantity be available in supply system because procurement lead time prevents rapid replacement of item.
PC	Item procured and stocked and which would otherwise be coded PA except that it is deteriorative in nature.
PD	Support item, excluding support equipment, procured for initial issue or outfitting and stocked only for subsequent or additional initial issues or outfittings. Not subject to automatic replenishment.
PE	Support equipment procured and stocked for initial issue or outfitting to specified maintenance repair activities.
PG	Item procured and stocked to provide for sustained support for the life of the equipment. It is applied to an item peculiar to the equipment which because of probable discontinuance or shut down of production facilities would prove uneconomical to reproduce at a later time.
KD	An item of depot overhaul/kit and not purchased separately. Depot kit defined as as a kit that provides items required at the time of overhaul or repair.
KF	An item of a maintenance kit and not purchased separately. Maintenance kit defined as a kit that provides an item that can be replaced at organizational or intermediate levels of maintenance.
KB	Item included in both a depot overhaul/repair kit and a maintenance kit.
MO	Item to be manufactured or fabricated at organizational level.
MF	Item to be manufactured or fabricated at the direct support level.
MH	Item to be manufactured or fabricated at the general support level.
MD	Item to be manufactured or fabricated at depot maintenance level.
AO	Item to be assembled at organizational level.
AF	Item to be assembled at direct support level.
AH	Item to be assembled at general support level.
AD	Item to be assembled at depot maintenance level.
XA	Item is not procured or stocked because the requirements for the item will result in the replacement of the next higher assembly.
XB	Item is not procured or stocked. If not available through salvage, requisition.
XC	Installation drawing diagram, instruction sheet, field service drawing, that is identified by manufacturer part number.

(2) *Maintenance codes:* Codes entered in the third and forth positions of the SMR Codes.

(*a*) *Third position:* The maintenance code entered in the third position will indicate the lowest maintenance level authorized to remove, replace, and use the item.

Code	*Explanation*
O	Support item is removed, replaced, and used at the organizational level of maintenance.
F	Support item is removed, replaced, and used at the direct support level.
H	Support item is removed, replaced, and used at the general support level.
D	Support items that are removed, replaced, and used at depot only.

(*b*) *Fourth position:* The maintenance code entered in the fourth position indicates whether the item is to be repaired and identifies

the lowest maintenance level with the capability to perform complete repair.

Code	*Explanation*
O	The lowest maintenance level capable of complete repair of the support item is the organizational level.
F	The lowest maintenance level capable of complete repair of the support item is the direct support level.
H	The lowest maintenance level capable of complete repair of the support item is the general support level.
D	The lowest maintenance level capable of complete repair of the support item is the depot level.
L	Repair restricted to designated Specialized Repair Activity.
Z	Nonrepairable. No repair is authorized.
B	No repair is authorized. The item may be reconditioned by adjusting, lubricating, etc., at the user level. No parts or special tools.

(3) *Recoverability code:* Code entered in the fifth position. Recoverability codes are assigned to support items to indicate the disposition action on unservicable items.

Code	*Explanation*
Z	Nonrepairable item. When unserviceable, condemn and dispose of the level indicated in column three.
O	Repairable item. When uneconomically repairable, condemn and dispose at organizational level.
F	Repairable item. When uneconomically repairable, condemn and dispose at the direct support level.
H	Repairable item. When uneconomically repairable, condemn and dispose at the general support level.
D	Repairable item. When beyond lower level repair capability, return to depot. Condemnation and disposal not authorized below depot.
L	Repairable item. Repair, condemnation and disposal not authorized below depot/Specialized Repair Activity level.
A	Item requires special handling or condemnation procedures because of specific reasons (i.e., precious metal content, high dollar value, critical material, or hazardous material). Refer to appropriate manuals/directives for specific instructions.

b. Federal Stock Number. Indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. Indicates the Federal item name and a minimum description required to identify the item. The last line indicates the reference number followed by the applicable Federal Supply Code for Manufacturer (FSCM) in parentheses. The FSCM is used as an element in item identification to designate manufacturer or distributor or Government agency, etc., and is identified in SB 708–42.

d. Unit of Measure (U/M). Indicates the standard or basic quantity by which the listed item is used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation; e.g., ea., in., etc. When the unit of measure differs from the unit of issue, the lowest unit of issue that will satisfy the required units of measure will be requisitioned.

e. Quantity Incorporated in Unit. Indicates the quantity of the item used in the breakout shown on the illustration figure, which is prepared for a functional group, subfunctional group, or an assembly. A "V" appearing in this column in lieu of a quantity indicates that no specific quantity is applicable, e.g., shims, spacers, etc.

f. 15-Day Organizational Maintenance Allowances. The allowance columns are divided into four subcolumns. An asterisk in these columns opposite the first appearance, and each subsequent appearance, of each item indicates the repair part is authorized on an "as required" basis. Stockage will be based on demand in accordance with AR 710–2.

g. Illustrations. This column is divided as follows:

(1) *Figure number.* Indicates the figure number of the illustration on which the item is shown.

(2) *Item number.* Indicates the callout number used to reference the item on the illustration.

4. Special Information

The following Publications are applicable to the installation and maintenance of the AN/ARC–102.

DA Pam 310–4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310–7	U.S. Army Equipment Index of Modification Work Orders.
TM 11–5821–248–12	Operator's and Organizational Maintenance Manual: Radio Set AN/ARC–102

TM 11–5821–248–20P Organizational Maintenance Repair Parts and Special Tool Lists: Radio Set AN/ARC–102.

5. How to Locate Repair Parts (Not Applicable)

6. Abbreviations (Not Applicable)

7. Reporting of Equipment Publications Improvements

The reporting of errors, omissions, and recommendations for improving this publication is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications) and forwarded direct to Commander, US Army Electronics Command, ATTN: AMSEL–MA–A, Fort Monmouth, N.J., 07703.

SECTION II. REPAIR PARTS FOR ORGANIZATIONAL MAINTENANCE

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION Reference Number & Mfr Code	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 15-DAY ORGANIZATIONAL MAINTENANCE ALW (a) 1-5	(b) 6-20	(c) 21-50	(d) 51-100	(7) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
		GROUP 01									
		RADIO SET AN/ARC-102									
PDOFD	5821-019-8405	CONTROL, RADIO SET C-3940/ARC-94 (80058)		EA	1	*	*	*	*	1	1
PDOHH	5821-682-1468	MOUNT, RECEIVER 554-5363-005 (13499)		EA	1	*	*	*	*	1	2
PDOHH	5821-758-5632	MOUNT, RECEIVER 554-5375-005 (13499)		EA	1	*	*	*	*	1	2
PDOHD	6130-719-7219	STATIC, INVERTER 522-2929-00 (13499)		EA	1	*	*	*	*	1	3

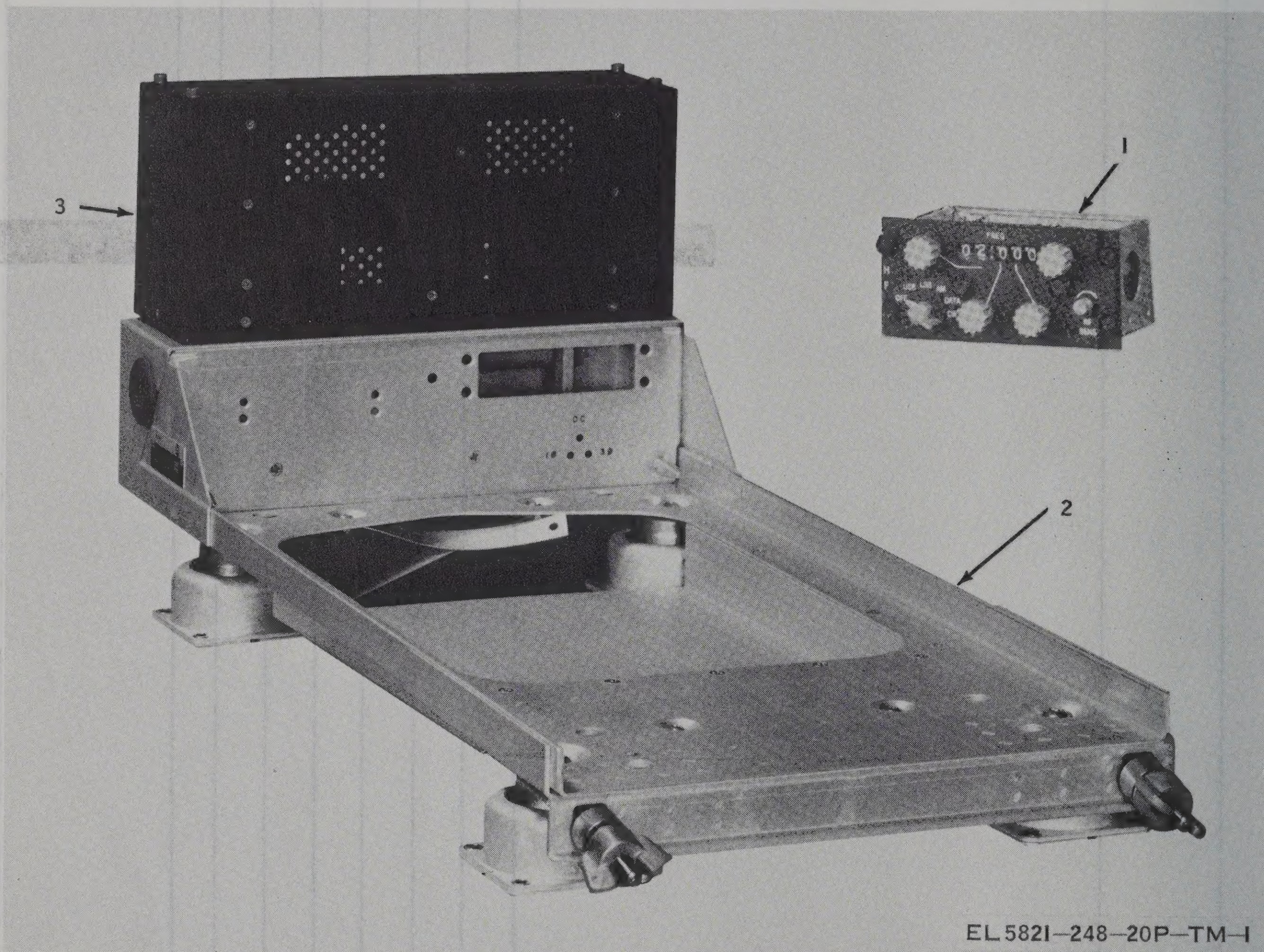

Figure 1. Radio Set, AN/ARC-102.

By Order of the Secretary of the Army:

CREIGHTON W. ABRAMS
General, United States Army
Chief of Staff

Official:
VERNE L. BOWERS
Major General, United States Army
The Adjutant General

Distribution:
To be distributed in accordance with DA Form 12–36 (qty rqr block no. 121), Organizational maintenance requirements for avionics literature, AN/ARC–102.

* U.S. GOVERNMENT PRINTING OFFICE: 1973—510–858/3432A

TECHNICAL MANUAL)
)
TM 11-5821-248-35)

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 5 May 1964

RADIO SET AN/ARC-102

NOTE: Throughout this technical manual, paragraphs within each chapter are numbered consecutively beginning with paragraph 1. Figures are numbered consecutively in each chapter but are inserted as a series (i. e. Chapter 2, figures 1-30, Chapter 3, figures 101-108). Tables in each chapter are numbered in the same manner as figures within that chapter. The schematic diagrams of the modules are located at the rear of this manual and are numbered consecutively starting with figure 1101.

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CHAPTER 1

INTRODUCTION

Table of Contents

List of Illustrations

1. SCOPE OF MANUAL.

A. This manual contains instructions for direct support, general support, and depot maintenance for Radio Set AN/ARC-102, (fig. 1, chapter 2). It includes instructions appropriate to direct and general support and depot maintenance for troubleshooting, testing, replacing maintenance parts, and repairing specified maintenance parts. It also lists the tools, materials, and test equipment required for direct support, general support, and depot maintenance. Appendix I contains a list of reference publications and appendix II provides description, use, and schematic diagrams of special test equipment (para 7B) required for maintenance

Note: For applicable forms and records, see paragraph 3, TM 11-5821-248-12.

B. The purpose, operation, and interoperation of the various circuits (electrical, electronic, mechanical, electromechanical) in this equipment are explained in chapter 2. Familiarity with the equipment, how it works, and why it works that way are valuable tools in troubleshooting the equipment rapidly and effectively.

C. The complete technical manual for this equipment includes TM 11-5821-248-12.

D. Throughout this manual, equipment commercial designations are used. Some of the equipments have been assigned Military nomenclature; these are listed below:

Military nomenclature	Collins Radio Co. Type No.
Receiver-Transmitter RT-698/ARC-102	Airborne SSB Transceiver 618T-3
Control, Radio Set C-3940/ARC-94	Control Unit 714E-3
Power, Inverter-Mounting PP-3702/ARC-102	Shockmount 390J-2
Network, Impedance Matching CU-991/AR	Antenna Tuner 180L-2
Antenna Coupler Group AN/ARA-41	Antenna Coupler 180R-6
Test Set, Radio AN/ARM-73	Test Harness 678P-1 (Appendix II)
Maintenance Kit, Electronic Equipment ME-722/ARC-102	Maintenance Kit 678Y-1 and Function Test Set 678Z-1 (Appendix II)

2. INDEX OF PUBLICATIONS.

Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment. D A Pam 310-4 is an index of current technical manuals, technical bulletins, supply manuals, supply bulletins, lubrication orders, and modification work orders that are available through publications supply channels. The index lists the individual parts (10, -20, -35P, etc) and the latest changes to and revisions of each publication.

3. REPORTING OF EQUIPMENT MANUAL IMPROVEMENTS.

The direct reporting, by the individual user, of errors, omissions, and recommendations for improving this equipment manual is authorized and encouraged. DA Form 2028 (Recommended changes to DA technical manual parts lists or supply manual 7,8,or9) will be used for reporting these improvements. This form will be completed in triplicate using pencil, pen, or typewriter. The original and one copy will be forwarded direct to: Commanding Officer, U. S. Army Electronics Materiel Support Agency, ATTN: SELMS-MP, Fort Monmouth, New Jersey 07703. One information copy will be furnished to the individual's immediate supervisor (officer, noncommissioned officer, supervisor, etc).

4. EQUIPMENT COMPONENTS.

Radio Set AN/ARC-102 consists of:

(1) Receiver-Transmitter RT-698/ARC-102 (Collins Radio Co. type 618T-3).

(2) Control, Radio Set C-3940/ARC-94 (Collins Radio Co. type 714E-3).

(3) Power, Inverter-Mounting PP-3702/ARC-102 (Collins Radio Co. type 390J-2).

Note: Network, Impedance Matching CU-991/AR (Collins Radio Co. type 180L-2, TM 11-5915-201-15) and Antenna Coupler Group AN/ARA-41 (Collins Radio Co. type 180R-6, TM 11-5821-249-15) or equivalents are required to match the impedance of the receiver-transmitter unit to the AN/ARC-102 antenna (not part of AN/ARC-102) mounted on the surface of the aircraft.

Warning: Be extremely careful when troubleshooting the internal circuits of the receiver-transmitter unit; dangerous voltages exist in the unit. Always disconnect the equipment from the power source when making internal repairs or resistance measurements.

5. GENERAL TROUBLESHOOTING INFORMATION.

The direct support, general support, and depot maintenance instructions in this technical manual supplement the procedures described in the operator's and organizational maintenance manual (TM 11-5821-248-12). The systematic troubleshooting procedure, which begins with the operational checks that can be performed at the organizational maintenance level, is carried to a higher level in this manual. Sectionalizing, localizing, and isolating techniques used in the troubleshooting procedures are more advanced. Chapter 9 provides module troubleshooting procedures of the receiver-transmitter unit to be performed by direct support and general support maintenance facilities; chapters 3 through 8 describe disassembly, cleaning, inspection, repair, assembly, and testing procedures.

6. ORGANIZATION OF TROUBLESHOOTING PROCEDURES.

A. General.

The first step in troubleshooting a defective radio set is to sectionalize the fault. Sectionalization means tracing the fault to a major component. The second step is to localize the fault. Localization means tracing the fault to a faulty circuit or module. The third step is to isolate the fault. Isolation means tracing the fault to a defective part responsible for the abnormal condition. Some faults, such as burned-out resistors, arcing or shorted transformers can often be located by sight, smell, and hearing. The majority of faults, however, must be isolated by checking voltages and resistances.

B. Sectionalization.

Listed below is a group of tests arranged to reduce unnecessary work, and to aid in tracing trouble in a defective radio set. Radio Set AN/ARC-102 consists of three units: the receiver-transmitter, the control unit, and the mounting. The first step is to locate the unit or units at fault by the following methods:

(1) Visual inspection.

The purpose of visual inspection is to locate faults without testing or measuring circuits. The monitor meter on the front of the receiver-transmitter and other visual signs should be observed and an attempt made to sectionalize the fault to a particular unit.

(2) Operational tests.

Operational tests frequently indicate the general location of trouble. In many instances, the tests will help in determining the exact nature of the fault. The periodic preventive maintenance checks and services (TM 11-5821-248-12) is a good operational test.

C. Localization.

After the trouble has been sectionalized (B above) the methods listed below will aid in localizing the trouble to a circuit or module in the suspected unit.

(1) Troubleshooting charts.

The trouble symptoms in the troubleshooting charts (chapter 9) provide additional information for localizing troubles.

(2) Signal substitution.

Signal substitution may enable the repairman to localize a trouble quickly to a stage or module. A signal generator, audio oscillator, and oscilloscope are units of test equipment (para 7) that may be used for signal substitution.

D. Isolation.

After the trouble has been localized (C above), the methods listed in (1) through (6) below will aid in isolating the trouble to a defective circuit element.

(1) Waveform analysis.

For some circuits in this equipment waveforms must be taken and compared with the waveforms given. Resistance measurements ((3) below) must then be taken to isolate the trouble.

(2) Voltage measurements.

Portions of this equipment are transistorized. When measuring voltages, use tape or sleeving (spaghetti) to insulate the entire test prod, except for the extreme tip. A momentary short circuit can ruin a transistor. Use the same or equivalent item of test equipment specified in the procedures.

(3) Resistance measurements.

Make resistance measurements in this equipment only as directed. Use the test equipment range specified in the procedures, otherwise the indications obtained may be inaccurate.

CAUTION: BEFORE USING ANY ITEM OF TEST EQUIPMENT TO TEST TRANSISTORS OR TRANSISTOR CIRCUITS, CHECK THE OPEN-CIRCUIT VOLTAGE ACROSS THE TEST EQUIPMENT LEADS. DO NOT USE

THE TEST EQUIPMENT IF THE OPEN-CIRCUIT VOLTAGE EXCEEDS 1.5 VOLTS. ALSO, SINCE THE RX1 RANGE NORMALLY CONNECTS THE TEST EQUIPMENT INTERNAL BATTERY DIRECTLY ACROSS THE TEST LEADS, THE COMPARATIVELY HIGH CURRENT (50 MA OR MORE) MAY DAMAGE THE TRANSISTOR UNDER TEST. AS A GENERAL RULE, IT IS NOT RECOMMENDED THAT THE RX1 RANGE OF ANY TEST EQUIPMENT BE USED WHEN TESTING LOW-POWER CIRCUITS.

(4) Test points.

Some of the modules of this equipment are equipped with test points to facilitate connection of test equipment. These test points should be used whenever specified to avoid needless disassembly of the equipment.

(5) Intermittent troubles.

In all of the tests, the possibility of intermittent troubles should not be overlooked. If present, this type of trouble often may be made to appear by tapping or jarring the equipment. Make a visual inspection of the wiring and connections to the units of the equipment. Minute cracks in printed circuit boards can cause intermittent operation. A magnifying glass is often helpful in locating defects in printed circuit boards. Continuity measurements of printed conductors may be made using the same technique ordinarily used on hidden conventional wiring; observe test equipment precautions discussed in (3) above.

(6) Resistor and capacitor color code diagrams.

Resistor and capacitor color code diagrams (fig. 1 and 2) are provided to aid maintenance personnel in determining the value, voltage rating, and tolerance of capacitors and resistors.

7. TEST EQUIPMENT REQUIRED.

A. The chart below lists the test equipment required to maintain the equipment. One column of the chart lists the commercial test equipments and their designations, the other column lists the military equivalents or substitutes. Commercial designations are used throughout this manual.

Commercial designation	Military equivalent or substitute
Ballentine 310A voltmeter	Voltmeter, Meter ME-30A/U
Bird 82C dummy r-f load	Dummy Load DA-25
Boonton 91-C voltmeter	Voltmeter, Electronic AN/URM-145
Fluke 801B voltmeter	Voltmeter, Electronic AN/USM-98

7A. TEST EQUIPMENT REQUIRED (cont)

Commercial designation	Military equivalent or substitute
Hewlett-Packard 200AB audio oscillator	Audio Oscillator TS-382/U
Hewlett-Packard 410B voltmeter with 455A probe "T" connector	Multimeter ME-26B/U
Hewlett-Packard 524D frequency counter with type 525A frequency converter	Frequency Meter AN/USM-26A
Hewlett-Packard 606A signal generator with Measurements Corp, 80-ZH3 6-db attenuator	R. F. Signal Generator AN/URM-25F
Tektronix 541 oscilloscope with type K plug-in head	Oscilloscope AN/USM-81
Triplett 630-NA voltohmmeter	Multimeter TS-352/U

B. The following items of special test equipment are required to maintain the equipment. Commercial designations are used throughout this manual. The description, use, and schematic diagrams of these items are provided in appendix II.

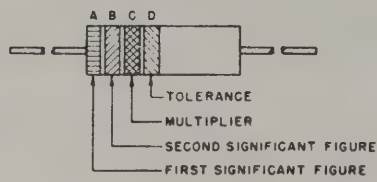
(1) Test Harness 689P-1, Collins part No. 547-3914-00 (Test Set, Radio AN/ARM-73).

(2) Maintenance Kit 678Y-1, Collins part No. 547-3915-00 (p/o Maintenance Kit, Electronic Equipment MK-722/ARC-102).

(3) Function Test Set 678Z-1, Collins part No. 548-8001-005 (p/o Maintenance Kit, Electronic Equipment MK-722/ARC-102).

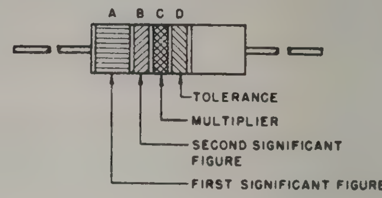
COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS

COMPOSITION-TYPE RESISTORS



BAND A— Equal Width Band Signifies Composition-Type

WIREWOUND-TYPE RESISTORS



BAND A— Double Width Signifies Wire-wound Resistor

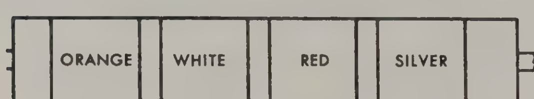
COLOR CODE TABLE

BAND A		BAND B		BAND C		BAND D*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1		
BROWN	1	BROWN	1	BROWN	10		
RED	2	RED	2	RED	100		
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000	SILVER	± 10
GREEN	5	GREEN	5	GREEN	100,000	GOLD	± 5
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	SILVER	0.01		
WHITE	9	WHITE	9	GOLD	0.1		

EXAMPLES OF COLOR CODING

BAND

A B C D*



3 9 X100 ± 10%

BAND

A B C D*

3 6 X0.1 ± 5%

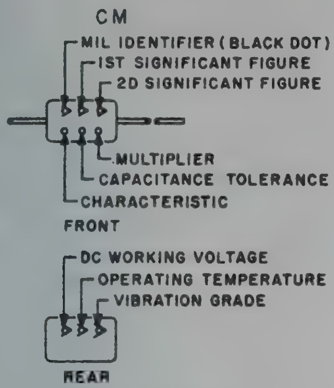
NOMINAL RESISTANCE	3,900 Ohms	3.6 Ohms
RESISTANCE TOLERANCE	± 10 percent	± 5 percent

STD-R2

*If Band D is omitted, the resistor tolerance is ±20%, and the resistor is not Mil-Std.

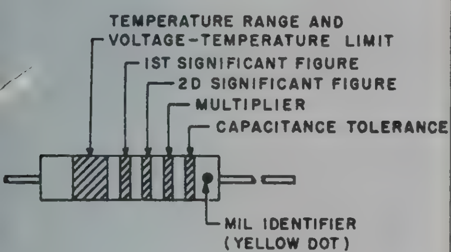
Figure 1. MIL-STD resistor color code markings.

GROUP I Capacitors, Fixed, Various-



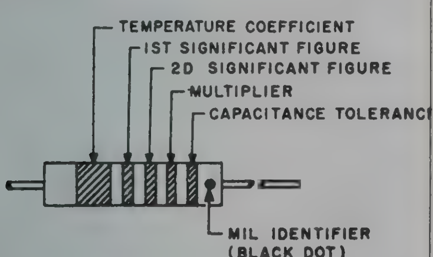
MICA-DIELECTRIC

GROUP II Capacitors, Fixed Ceramic-



AXIAL LEAD

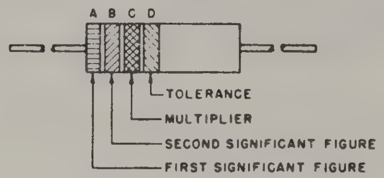
GROUP III Capacitors, Fixed, Ceramic



AXIAL LEAD

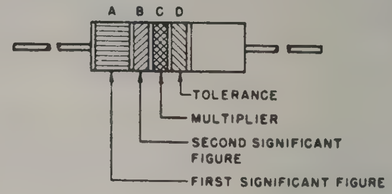
COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS

COMPOSITION-TYPE RESISTORS



BAND A— Equal Width Band Signifies Composition-Type

WIREWOUND-TYPE RESISTORS



BAND A— Double Width Signifies Wire-wound Resistor

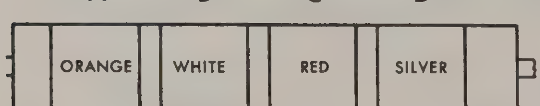
COLOR CODE TABLE

BAND A		BAND B		BAND C		BAND D*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1		
BROWN	1	BROWN	1	BROWN	10		
RED	2	RED	2	RED	100		
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000	SILVER	± 10
GREEN	5	GREEN	5	GREEN	100,000	GOLD	± 5
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	SILVER	0.01		
WHITE	9	WHITE	9	GOLD	0.1		

EXAMPLES OF COLOR CODING

BAND

A B C D*



3 9 X100 ± 10%

BAND

A B C D*

3 6 X0.1 ± 5%

NOMINAL RESISTANCE	3,900 Ohms	3.6 Ohms
RESISTANCE TOLERANCE	± 10 percent	± 5 percent

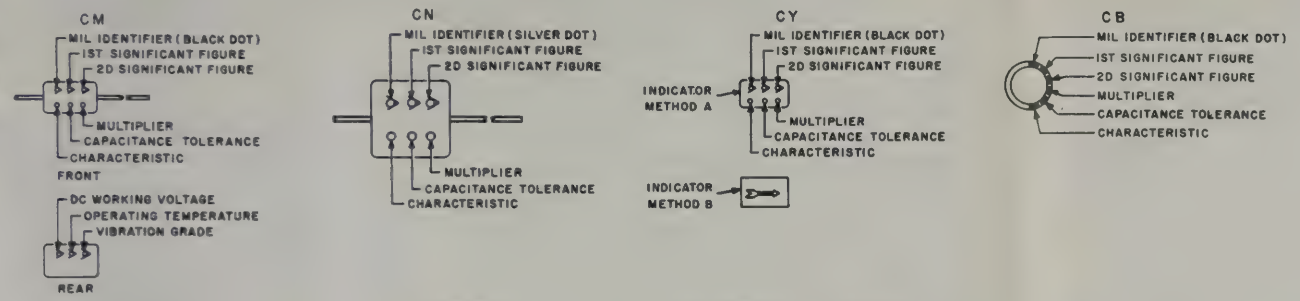
STD-R2

*If Band D is omitted, the resistor tolerance is ±20%, and the resistor is not Mil-Std.

Figure 1. MIL-STD resistor color code markings.

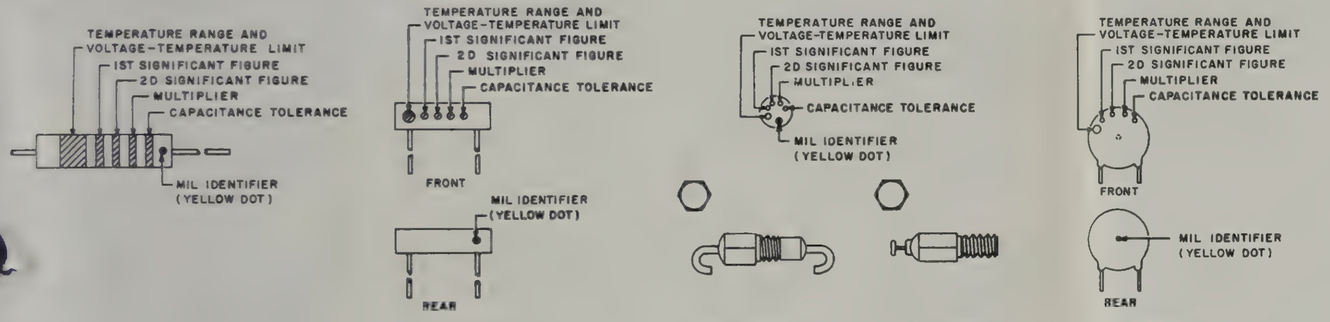
COLOR CODE MARKING FOR MILITARY STANDARD CAPACITORS

GROUP I Capacitors, Fixed, Various-Dielectrics, Styles CM, CN, CY, and CB



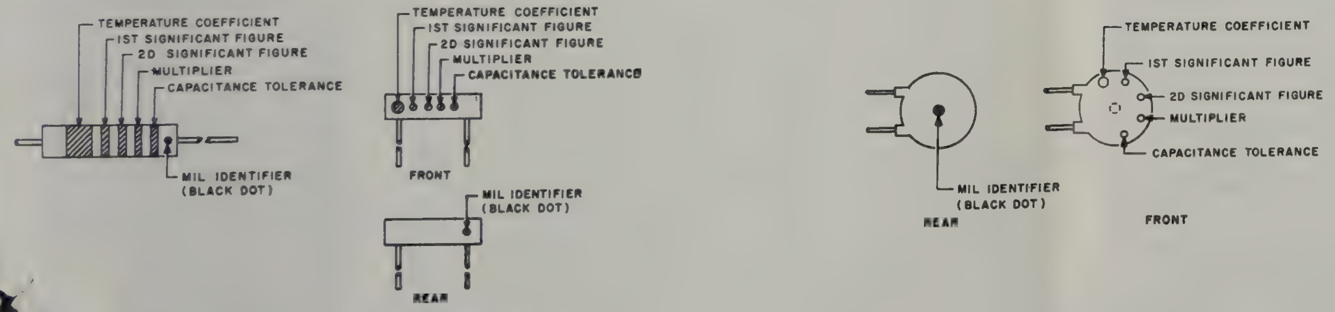
MICA-DIELECTRIC PAPER-DIELECTRIC GLASS-DIELECTRIC, GLASS CASE MICA, BUTTON TYPE

GROUP II Capacitors, Fixed Ceramic-Dielectric (General Purpose) Style CK



AXIAL LEAD RADIAL LEAD FEED-THROUGH STAND-OFF DISK-TYPE

GROUP III Capacitors, Fixed, Ceramic-Dieletric (Temperature Compensating) Style CC



AXIAL LEAD RADIAL LEAD DISK-TYPE

COLOR CODE TABLES

TABLE I – For use with Group I, Styles CM, CN, CY and CB

COLOR	MIL ID	1st SIG FIG	2nd SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE				CHARACTERISTIC[2]				DC WORKING VOLTAGE	OPERATING TEMP. RANGE	VIBRATION GRADE
					CM	CN	CY	CB	CM	CN	CY	CB	CM	CM	CM
BLACK	CM, CY CB	0	0	1			± 20%	± 20%		A				−55° to +70°C	10–55 cps
BROWN		1	1	10					B	E		B			
RED		2	2	100	± 2%		± 2%	± 2%	C		C			−55° to +85°C	
ORANGE		3	3	1,000		± 30%			D			D	300		
YELLOW		4	4	10,000					E					−55° to +125°C	10–2,000 cps
GREEN		5	5		± 5%				F				500		
BLUE		6	6											−55° to +150°C	
PURPLE (VIOLET)		7	7												
GREY		8	8												
WHITE		9	9												
GOLD				0.1			± 5%	± 5%							
SILVER	CN				± 10%	± 10%	± 10%	± 10%							

TABLE II – For use with Group II, General Purpose, Style CK

COLOR	TEMP. RANGE AND VOLTAGE – TEMP. LIMITS[3]	1st SIG FIG	2nd SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE	MIL ID
BLACK		0	0	1	± 20%	
BROWN	AW	1	1	10	± 10%	
RED	AX	2	2	100		
ORANGE	BX	3	3	1,000		
YELLOW	AV	4	4	10,000		CK
GREEN	CZ	5	5			
BLUE	BV	6	6			
PURPLE (VIOLET)		7	7			
GREY		8	8			
WHITE		9	9			
GOLD						
SILVER						

TABLE III – For use with Group III, Temperature Compensating, Style CC

COLOR	TEMPERATURE COEFFICIENT[4]	1st SIG FIG	2nd SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE		MIL ID
					Capacitances over 10uuf	Capacitances 10uuf or less	
BLACK	0	0	0	1		± 2.0uuf	CC
BROWN	−30	1	1	10	± 1%		
RED	−80	2	2	100	± 2%	± 0.25uuf	
ORANGE	−150	3	3	1,000			
YELLOW	−220	4	4				
GREEN	−330	5	5		± 5%	± 0.5uuf	
BLUE	−470	6	6				
PURPLE (VIOLET)	−750	7	7				
GREY		8	8	0.01			
WHITE		9	9	0.1	± 10%		
GOLD	+100					± 1.0uuf	
SILVER							

1. The multiplier is the number by which the two significant (SIG) figures are multiplied to obtain the capacitance in uuf.
2. Letters indicate the Characteristics designated in applicable specifications: MIL–C–5, MIL–C–91, MIL–C–11272, and MIL–C–10950 respectively.
3. Letters indicate the temperature range and voltage-temperature limits designated in MIL–C–11015.
4. Temperature coefficient in parts per million per degree centigrade.

STD–C2

Figure 2. MIL STD capacitor color code markings.

CHAPTER 2

DESCRIPTION AND OPERATION

CHAPTER 2

DESCRIPTION AND OPERATION

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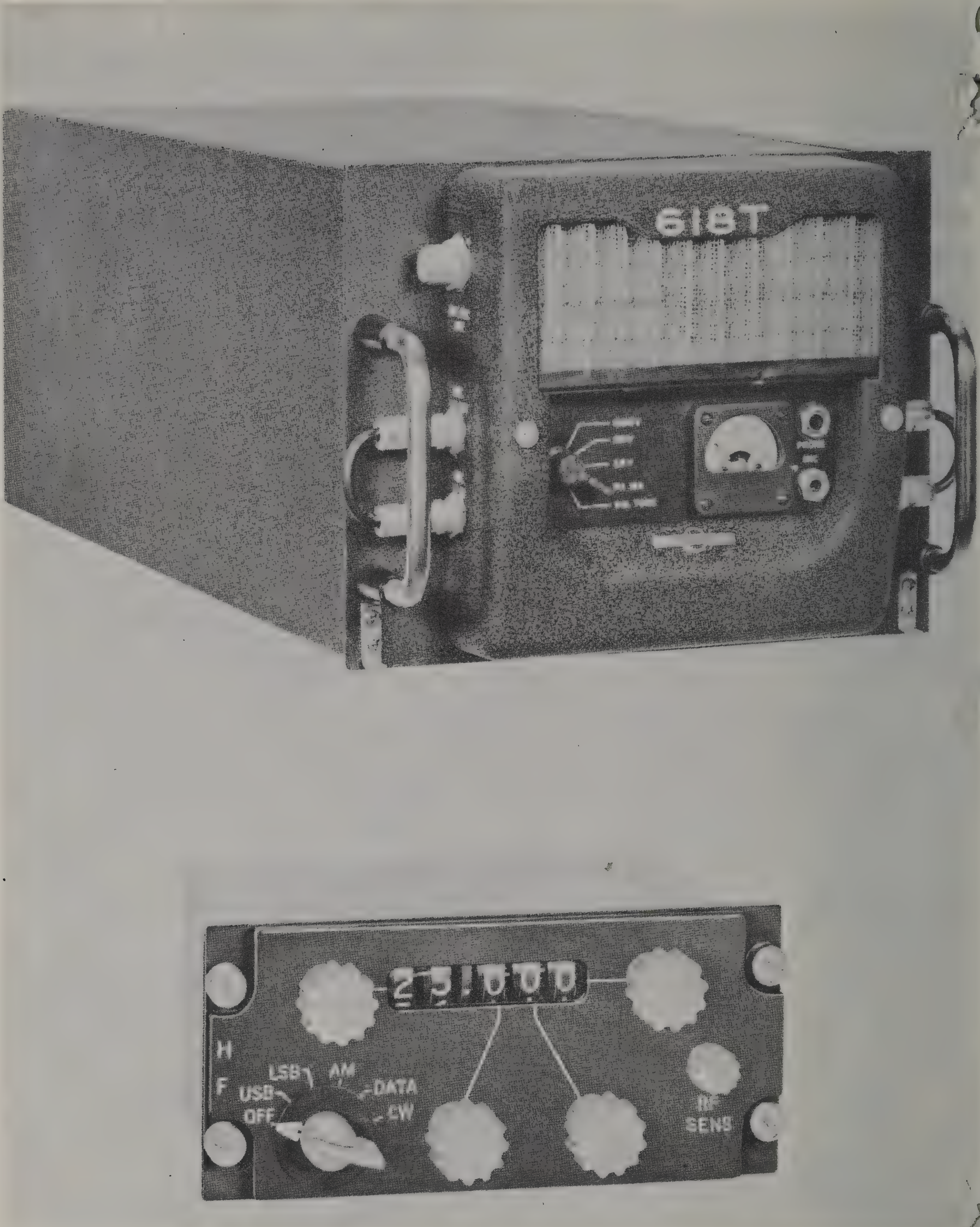


Airborne SSB Transceiver 618T-( ) and Control Unit 714E-3
Figure 1

1. GENERAL.

This chapter provides physical description, technical data, single-sideband theory, and internal operation of Radio Set AN/ARC-102. Familiarity with the equipment, its physical and technical characteristics, and its internal operation are valuable tools in troubleshooting the equipment rapidily and effectively.

2. DESCRIPTION OF EQUIPMENT.

A. Physical.

Airborne SSB Transceiver 618T-( ) is shown in figure 1. The 618T-( ) weighs 50 pounds and is contained in a standard 1 ATR case which is 22-3/16 inches deep, 7-5/8 inches high, and 10-1/8 inches wide. A PHONE jack, MIC jack, meter, and meter selector switch are located on the front panel of the 618T-( ). Four meter selector switch positions are used to check supply voltages in the 618T-( ). A fifth position, CAL TONE, is used to compare the frequency of the 618T-( ) with WWV. A 400-cycle blower is also located on the front panel to provide forced-air cooling. Antenna connections are made at the front of the 618T-( ). All other connections are made at a 60-pin connector at the rear of the 618T-( ). A separate grounding pin is located beside the 60-pin connector.

The 618T-( ) is composed of 11 plug-in modules, including an interchangeable internal power supply (subparagraph C). Each module is equipped with plug-in connectors and locating pins. The locating pins prevent improper location of the module on the chassis, and align the connectors before engagement occurs to prevent damage to the connectors. There are no mechanical linkages (gear trains, etc.) between any of the 618T-( ) modules. The modulator construction simplifies maintenance of the 618T-( ). Color-coded test points on the modules permit general troubleshooting without removing modules from the chassis. Transistors are widely used in the 618T-( ) to increase reliability and reduce weight and power consumption.

The 618T-( ) is completely remote controlled from Control Unit 714E-( ). Any one of 28,000 channels, spaced 1 kilocycle apart in the 2- to 30-megacycle range, can be directly selected at the control unit by rotating the four frequency selector knobs until the operating frequency is displayed in the window on the front of the unit. The mode selector switch at the left front corner of the 714E-1 and 714E-2 controls on-off, sideband selection, and AM operation. The 714E-3 (see figure 1) has two additional positions: DATA and CW. An r-f gain control, labeled RF SENS, is located on the right front of all three units.

Control Units 714E-1 and 714E-2 are similar, but not interchangeable. Either the 714E-1 or 714E-2 may be used in new installations by using the proper interwiring. The 714E-1 cannot be used in retrofit installations. The 714E-3 is used in installations which include data equipment or which are to be operated in the CW mode. Additional equipment needed to transmit data can be activated by placing the mode selector switch in the DATA position. When the switch is in the CW position, the upper sideband filter is switched into the circuit, and

the aircraft CW keyline is connected to the 618T-( ) CW keyline.

B. Electrical.

The operating frequency of the 618T-( ) is crystal controlled and stabilized to within 0.8 part-per-million per month. The 618T-( ) is capable of 400 watts PEP output in sideband operation and 100 watts carrier output into a 52-ohm load in AM or CW operation.

The tuned circuits and output circuit of the 618T-( ) are automatically tuned by either an Autopositioner* or a servo motor. The receiver portion of the transceiver is muted during tuning. The average tuning time, independent of an external antenna tuner, is 8 seconds.

A complete discussion of the principles of operation of the 618T-( ) is given in paragraph 5.

C. Model Differences.

There are three models of the 618T-( ). The three models differ only in the type of high-voltage power supply used in each. The following paragraphs describe the three models.

(1) Airborne SSB Transceiver 618T-1.

The 618T-1 retrofits most 618S installation with no changes in aircraft wiring. Power Supply 516H-1 is mounted in the same shockmount which contained Power Supply 416W. The primary power source for the 618T-1 is 27.5 volts d-c.

(2) Airborne SSB Transceiver 618T-2.

The 618T-2 has a completely self-contained high-voltage power supply for use with a 115-volt, 400-cycle, 3-phase primary power source.

(3) Airborne SSB Transceiver 618T-3.

The 618T-3 has a completely self-contained high-voltage power supply for use with a 27.5-volt d-c primary power source. The 618T-3 may also be retrofitted into some 618S-( ) installations.

*Registered in U. S. Patent Office.

3. TECHNICAL DATA SUMMARY.

A. Specifications 618T-( ).

(1) General.

Ambient Temperature Range	-40 to +55° C with 30 minutes operation at +70°C.
Ambient Humidity Range	Up to 95 percent relative humidity at 50°C for 48 hours.
Altitude Range	Pressure equivalent of 40,000 feet with externally-supplied cooling air.
Power Requirements.	618T-1 with 516H-1: 27.5 volts d-c, approximately 900 watts. 115 volts, 400 cps, 1 phase, approximately 150 watts. 618T-2: 115 volts (line to neutral), 3-phase, 400 cps, approximately 700 watts. 27.5 volts d-c, approximately 100 watts. 618T-3: 27.5 volts d-c, approximately 950 watts. 115 volts, 400 cps, 1 phase, approximately 100 watts.
Frequency Range	2.000 to 29.999 megacycles.
Frequency Channels	28,000.
Frequency Stability	0.8 part-per-million per month.
Time Required to Change Channels	8 seconds average (independent of external antenna tuner).

(2) Transmit Characteristics.

R-F Power Output	SSB: 400 watts PEP ±1 db. AM: 100 watts carrier. CW: 100 watts, locked key.
R-F Output Impedance	52 ohms.

Audio Input Impedance	100 ohms unbalanced and 600 ohms balanced.
Audio Frequency Response	5 db peak-to-valley ratio from 300 to 3000 cps.
Distortion	SSB: Third order distortion products down at least 30 db.
	AM: Less than 20 percent at 80 percent modulation.

(3) Receive Characteristics.

Sensitivity	SSB: 1 microvolt for 10-db S+N/N ratio.
	AM: 3 microvolts modulated 30 percent 1000 cps for a 6-db S+N/N ratio.
Selectivity	SSB: 2.85 kc, 6 db down. 6.0 kc, 60 db down.
	AM: 5.5 kc, 6 db down. 14.0 kc, 60 db down.
AGC Characteristic	Maximum variation of audio output is 6 db for input signals from 10 to 100,000 microvolts. No overload below 1-volt signal output.
I-F and Image Rejection	80 db, minimum.
Audio Output Power	100 milliwatts into 300-ohm load.
Audio Distortion	Less than 10 percent.
Audio Frequency Response	5-db peak-to-valley ratio from 300 to 3000 cps.

B. Module Complement.

Table 1 lists the modules used in Airborne SSB Transceiver 618T-( ).

C. Transistor Complement.

Table 2 lists the transistors used in Airborne SSB Transceiver 618T-( ).

D. Vacuum-Tube Complement.

Table 3 lists the vacuum tubes used in Airborne SSB Transceiver 618T-( ).

E. Diode Complement.

Table 4 lists the diodes used in Airborne SSB Transceiver 618T-( ).

F. Relay Complement.

Table 5 lists the relays used in Airborne SSB Transceiver 618T-( ).

G. Motor Complement.

Table 6 lists the motors used in Airborne SSB Transceiver 618T-( ).

TABLE 1. 618T-( ) MODULE COMPLEMENT

MODULE	FUNCTION
A1	Frequency Divider
A2	Radio-Frequency Oscillator
A3	I-F Translator
A4	Kilocycle Frequency Stabilizer
A5	Low Voltage Power Supply
A6	Electronic Control Amplifier
A7	Three-Phase High-Voltage Power Supply
A8	27.5-Volt D-C High-Voltage Power Supply
A9	AM/Audio Amplifier
A10	Megacycle Frequency Stabilizer
A11	Power Amplifier
A12	R-F Translator
A12A1	Autopositioner (Submodule)
A12A2	Variable Frequency Oscillator (VFO) (Submodule)
A13	Single-Phase High-Voltage Power Supply
	Chassis

TABLE 2. 618T-( ) TRANSISTOR COMPLEMENT

MODULE SYMBOL	LOCATION	TRANSISTOR SYMBOL	TRANSISTOR TYPE	FUNCTION
A1	Frequency Divider	Q1	2N1285	Emitter Follower
		Q2	2N1285	Locked Oscillator
		Q3	2N1285	Emitter Follower
		Q4	2N697	Locked Oscillator
		Q5	2N1285	Pulse Inverter
		Q6	2N697	Blocking Oscillator
		Q7	2N1285	Isolation Amplifier
		Q8	2N1285	Locked Oscillator
		Q9	2N1285	Switch
		Q10	2N491	Unijunction Divider
		Q11	2N1285	Pulse Amplifier
		Q12-Q13	2N404	1-Kc Keyer
		Q14	2N1285	Keyed Oscillator
A2	R-F Oscillator	Q1-Q3		Temperature-Compensated Oscillator
		Q4	2N703	Locked Oscillator
		Q5	2N703	500-Kc Amplifier
		Q6	2N703	500-Kc Amplifier
		Q7	2N703	Emitter Follower
		Q8	2N703	Locked Oscillator
		Q9	2N703	100-Kc Amplifier

TABLE 2.618T-( ) TRANSISTOR COMPLEMENT (Cont)

MODULE SYMBOL	LOCATION	TRANSISTOR SYMBOL	TRANSISTOR TYPE	FUNCTION
A3	I-F Translator	Q1	2N78	ALC Amplifier
		Q2-Q5	2N274	I-F Amplifiers
		Q6	2N542	TGC-ADC Amplifier
A4	Kilocycle-Frequency Stabilizer	Q1	2N1285	VFO Isolation Amplifier
		Q2	2N1285	1st Mixer
		Q3	2N1285	2nd Mixer
		Q4	2N1285	Isolation Amplifier
		Q5-Q8	2N1285	Signal I-F Amplifiers
		Q9	2N332	10-Kc Keyer
		Q10	2N706	10-Kc Keyer
		Q11	2N128	Keyed Oscillator
		Q12	2N1285	Digit Oscillator
		Q14	2N1285	Isolation Amplifier
		Q15	2N1285	Reference Mixer
		Q16-Q19	2N1285	Reference I-F Amplifiers
A5	Low-Voltage Power Supply	Q1	2N670	Transient Blanker Switch
		Q2	2N458	Transient Blanker Switch

TABLE 2. 618T-( ) TRANSISTOR COMPLEMENT (Cont)

MODULE SYMBOL	LOCATION	TRANSISTOR SYMBOL	TRANSISTOR TYPE	FUNCTION
A5 (Cont)		Q3	2N1131	Regulator Amplifier
		Q4	2N332	Regulator Amplifier
		Q5	2N550	Regulator Controller
A6	Electronic Control Amplifier	Q1-Q4	2N651	Amplifiers
		Q5	2N457	Driver
		Q6-Q7	2N457	Push-Pull Output Amplifiers
A8	27.5-Volt D-C High-Voltage Power Supply	Q1-Q2	2N158A	Saturable-Core Oscillators
		Q3-Q6	2N1100	Push-Pull Switches
A9	AM/Audio Amplifier	Q1-Q2	2N158	Audio Amplifiers
		Q3-Q6	2N274	I-F Amplifiers
		Q7	2N274	AGC Amplifier
		Q8	2N651	Audio Amplifier
		Q9	2N651	Selcal Audio Amplifier
A10	Megacycle-Frequency Stabilizer	Q1	2N706	Squaring Amplifier
		Q2	2N2218	Pulse Generator
		Q3-Q4	2N489	Automatic Level Detectors
		A1Q1 A2Q1	2N1285	R-F Amplifiers
		A1Q2, A2Q2	2N706	R-F Amplifiers

TABLE 2. 618T-( ) TRANSISTOR COMPLEMENT (Cont)

MODULE SYMBOL	LOCATION	TRANSISTOR SYMBOL	TRANSISTOR TYPE	FUNCTION
A10 (Cont)		A1Q3 A2Q3	2N706	Mixers
		A1Q4 A2Q4	2N1285	I-F Amplifiers
A12A2	VFO Submodule	Q1	2N1196	Oscillator
		Q2	2N2189	Amplifier
		Q3	2N2189	Amplifier
		Q4	2N2189	Amplifier
516H-1	External Power Supply	Q1-Q2	2N458	Saturable-Core Oscillators
		Q3-Q8	2N1100	Push-Pull Switches
	Chassis	Q1	2N491	Time Delay Switch

TABLE 3. 618T-( ) VACUUM-TUBE COMPLEMENT

MODULE SYMBOL	LOCATION	TUBE SYMBOL	TUBE TYPE	FUNCTION
A12	R-F Translator	V1	12AT7WA	Transmit L-F Mixer
		V2	12AT7WA	Transmit 17.5-Mc Mixer
		V3	12AT7WA	Transmit H-F Mixer
		V4-V5	6DC6	R-F Amplifiers
		V6-V7	6CL6	Drivers
		V8	6AH6WA	Receive L-F Mixer
		V9	6AH6WA	Receive 17.5-Mc Mixer
		V10	6AH6WA	17.5-Mc Oscillator
		V11	6AH6WA	H-F Oscillator
		V12	12AT7WA	Receive H-F Mixer
A11	Power Amplifier	V1-V2	Eimac 7204/ 4CX250F	Power Amplifiers

TABLE 4. 618T-( ) DIODE COMPLEMENT

MODULE SYMBOL	LOCATION	DIODE SYMBOL	DIODE TYPE	FUNCTION
A1	Frequency Divider	CR1	1N270	Blocking Oscillator Circuit (Protects Q6)
		CR2	1N198	Switch Circuit
		CR3, CR4	1N627	Unijunction Divider Circuit
		CR5	1N627	Pulse Amplifier Circuit
A3	I-F Translator	CR1	1N252	Diode Quad Balanced Modulator
		CR3	HD2120	Protects Q2
		CR4	HD2120	Protects Q3
		CR5A/B	1N67	Product Detector
		CR6	HD2160	Transmit-Receive Switch
		CR7	HD2120	TGC Gate
A4	Kilocycle-Frequency Stabilizer	CR1, CR11	1N926	Frequency Discriminator
		CR3	1N457	Protects Q9
		CR4, CR5	1N457	Protects Q10
		CR6-CR8	1N2167A	VFO Bias (Referenced Breakdown)
		CR9, CR10	1N926	Phase Discriminator
		CR12	1N645	Digit Oscillator Circuit
		CR13	1N270	Keyed Oscillator Circuit
		CR14, CR15	1N457	Keyed Oscillator Circuit
		CR16	1N198	Keyed Oscillator Circuit
A5	Low-Voltage Power Supply	CR1	1N3018A	Transient Blanker Circuit (Breakdown)

TABLE 4. 618T-( ) DIODE COMPLEMENT (Cont)

MODULE SYMBOL	LOCATION	DIODE SYMBOL	DIODE TYPE	FUNCTION
A5 (Cont)		CR2	1N2621A	Regulator Circuit (Reference Breakdown)
		CR3	1N1492	Half-Wave Rectifier
A6	Electronic Control Amplifier	CR1, CR2	PS6903	Interstage Isolation (Breakdown)
A7	Three-Phase High-Voltage Power Supply	CR1-CR36	1N1492	Full-Wave Rectifiers
		CR37, CR38	1N1487	SSB TGC Rectifiers
A8	27.5-Volt D-C High-Voltage Power Supply	CR1-CR5	1N1487	Oscillator Circuit
		CR6-CR21	1N1492	Full-Wave Rectifiers
		CR22, CR23	1N1487	SSB TGC Gates
		CR24	1N2834B	Transient Suppressors
A9	AM/Audio Amplifier	CR1	1N645	SSB AGC Detector
		CR2	HD2120	SSB AGC Detector
		CR4	HD2120	AM Audio Detector
		CR5, CR6	HD2120	AM AGC Detectors
		CR7	HD2120	SSB AGC Detector
		CR8-CR10	1N645	CW Keying Circuit
		CR11	HD2120	AGC Gate
		CR12	1N645	Key Line Isolation
		CR13	SZ885	AGC Delay (Breakdown)
		CR14	1N645	1-Kc Tuned Circuit Switch
A10	Megacycle-Frequency Stabilizer	A1CR1 A2CR1	1N198	R-F Limiters
		A1CR2 A2CR2	1N198	AM Detectors
A11	Power Amplifier	CR1	1N1491	Half-Wave Bias Rectifier
		CR2A/B	1N198	Phase Discriminator
		CR3	1N198	ADC Rectifier

TABLE 4. 618T-( ) DIODE COMPLEMENT

MODULE SYMBOL	LOCATION	DIODE SYMBOL	DIODE TYPE	FUNCTION
A11 (Cont)		CR4	1N457	ADC Gate
		CR5	1N3004B	Bias Stabilization (Breakdown)
		CR6	1N3020B	TGC Reference Stabilization (Breakdown)
		CR7a, CR7b	10M20-0 Z2	400-Volt Screen Voltage Stabilization (Breakdown)
A12	R-F Translator	CR1	1N645	Capacity Switch
		CR5	1N645	Transient Suppressor
		CR6	1N67A	AGC Rectifier
		CR9	1N645	Switch
A12A1	Autopositioner	CR1	1N645	Transient Suppressors
	Submodule	CR2	1N645	Isolation
		CR3, CR4	1N645	Transient Suppressors
	Chassis	CR1, CR2	1N39B	Sidetone Relay Rectifiers
		CR3	1N645	Isolation Diode
		CR4	1N647	400-Cycle Interlock Relay Rectifier
		CR5, CR6	1N645	Transient Suppressors
A13	Single-Phase High-Voltage Power Supply	CR1-CR16	1N1492	Full-Wave Rectifiers

TABLE 5. 618T-( ) RELAY COMPLEMENT

MODULE SYMBOL	LOCATION	RELAY SYMBOL	NUMBER OF TRANSFER SWITCHES	FUNCTION
A3	I-F Translator	K1	2	T/R Relay
		K2	2	Sideband Selector

TABLE 5.618T-( ) RELAY COMPLEMENT (Cont)

MODULE SYMBOL	LOCATION	RELAY SYMBOL	NUMBER OF TRANSFER SWITCHES	FUNCTION
A3 (Cont)		K3	2	AM/SB Relay
		K4	2	AM/SB Relay
		K5	2	By-Pass Relay
A7	Three-Phase High-Voltage Power Supply	K1	4	Plate Contactor
		K2	3	Step Start
		K3	2	Overload
A8	27.5-Volt D-C High-Voltage Power Supply	K1	2	H-V On-Off
		K2	2	Overload
A9	AM/Audio Amplifier	K1	2	CW Keying Relay
		K2	2	CW T/R Delay Relay
A11	Power Amplifier	K1	2	PA Band-Switch Interlock Relay
		K2 (below MCN 4550)	1	Tune Power Relay
		K3 (MCN 4550 and above)	1	Tune Power Relay
A12	R-F Translator	K1	2	T/R Relay
		K2	2	T/R Relay
		K3	2	Band-Switch Motor Relay
		K4	2	T/R Relay
A12A1	Autopositioner Submodule	K1	2	1-Kc Motor Relay
		K2	3	10-Kc Motor Relay
A13	Single-Phase High-Voltage Power Supply Module	K1		H-V Delay
		K2		Overload
	Chassis (Relay Compartment)	K1	2	On-Off Relay
		K2	4	Keying Relay
		K3	4	Keying Relay
		K4	4	Recycle Relay

TABLE 5. 618T-( ) RELAY COMPLEMENT (Cont)

MODULE SYMBOL	LOCATION	RELAY SYMBOL	NUMBER OF TRANSFER SWITCHES	FUNCTION
A13 (Cont)		K5	2	Antenna Transfer Relay
		K6	2	Sidetone Relay
		K7	1	Time Delay Relay
		K8	2	18-Volt Delay Relay
		K9	2	400-Cycle Interlock Relay
		K10	2	27-Volt Interlock Relay

TABLE 6. 618T-( ) MOTOR COMPLEMENT

MODULE	SYMBOL	FUNCTION
Power Amplifier	B1	Band-Switch Motor
	B2	Servo Tuning Motor
R-F Translator	B1	Band-Switch Motor
Autopositioner	B1	1-Kc Motor
	B2	10-Kc and 100-Kc Motor
Chassis	B1	Blower

4. SINGLE SIDEBAND THEORY.

The single sideband (SSB) method of communication provided by the 618T-( ) has proved to be a much more efficient and reliable means of voice communications than the amplitude modulation (AM) method.

SSB and AM signals can be compared by considering the frequency spectrums that make up each signal. Refer to figure 2. An AM signal is composed of three parts: an r-f carrier frequency, an upper sideband (the carrier frequency plus the audio spectrum), and a lower sideband (the carrier frequency minus the audio spectrum). See figure 2(B). These two sidebands are always generated in any modulation process. All of the audio information is contained in only one sideband. The other sideband merely duplicates this information and the carrier contains no information. If the duplicated sideband and carrier were completely eliminated and only the other sideband transmitted, the amount of information transmitted would be exactly the same as if all three parts were transmitted.

This is what is done in SSB transmission; a single sideband is transmitted. Because the carrier and one sideband are eliminated, the SSB signal requires only half the bandwidth required by an AM signal. Therefore, twice as many SSB signals as AM signals can be contained in the same spectrum space. Since the SSB signal consists of a single sideband, the other sideband and carrier must be eliminated in the SSB signal generation process. The SSB signal is generated in the 618T-( ) as follows.

The polarity of the amplified audio input is reversed at a 500-kc rate by a diode chopper. This chopper is called a balanced modulator. The magnitude of the output of the balanced modulator depends on the magnitude of the audio input. When there is no audio input, there will be no balanced modulator output.

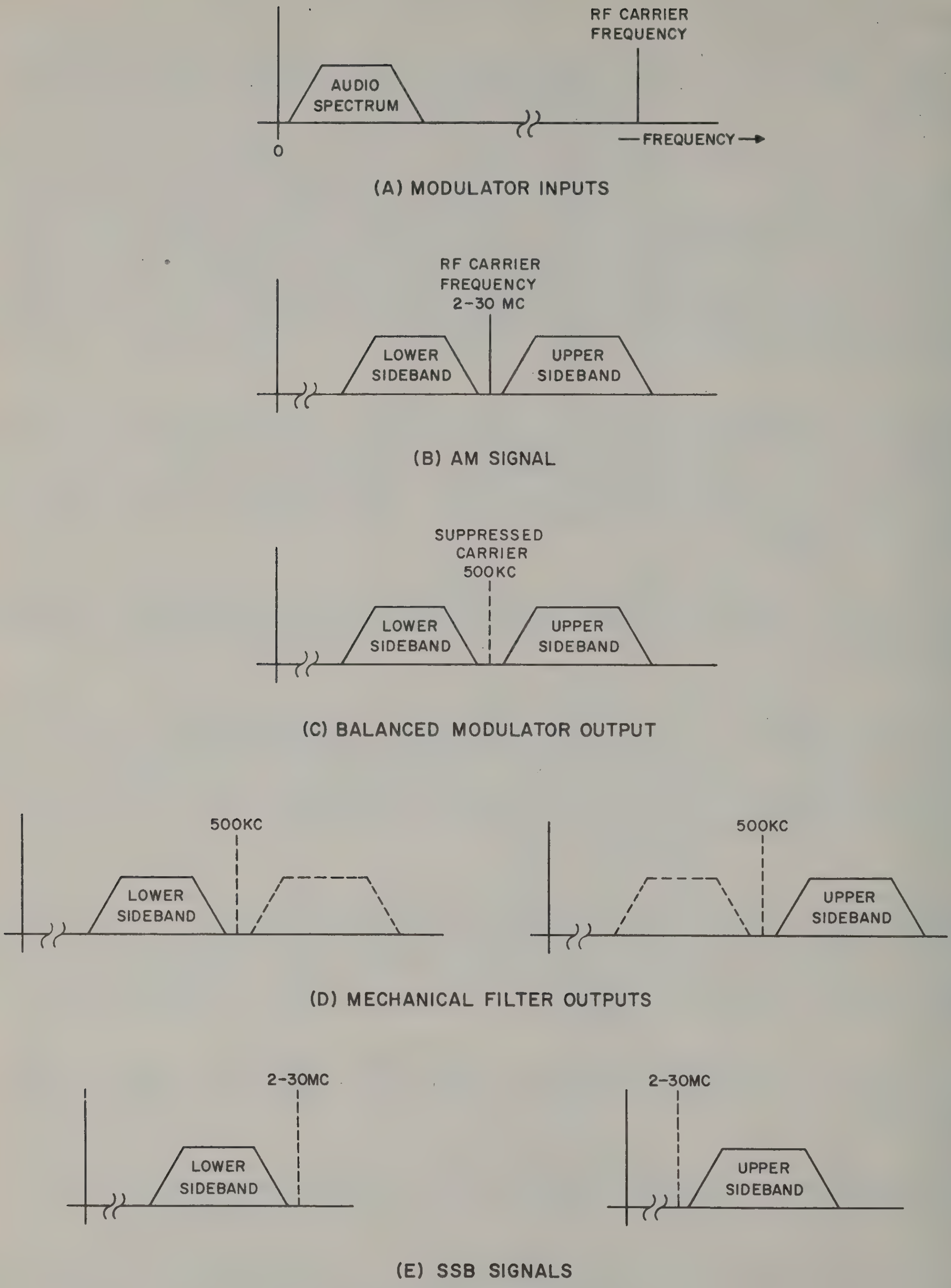
If the frequency spectrum of the balanced modulator output is analyzed, the upper and lower sidebands will be present, one on each side of 500 kc, just as in an AM modulator with a carrier frequency of 500 kc. Unlike the AM modulator output, however, the balanced modulator output contains a negligible 500-kc carrier frequency component. Thus, the carrier frequency has been balanced out, or suppressed, in the balanced modulator. See figure 2(C). The balanced modulator is described in more detail in paragraph 5.C.(1).

The double-sideband, suppressed-carrier signal from the balanced modulator is fed to one of two mechanical filters. The bandwidth of each filter is approximately 3 kc, enough to pass the audio spectrum. One filter passes only the upper sideband, and the other passes only the lower sideband. Either filter may be selected by the mode selector switch on the remote control unit. The filter output is a single sideband. See figure 2(D). This 500-kc i-f sideband is heterodyned in several mixers to the selected operating frequency.

The SSB generator, then, is essentially a frequency translating device that translates an audio spectrum to an r-f spectrum which may be on either side of a missing r-f carrier frequency. See figure 2(E).

Because the SSB signal is a translated audio spectrum, it must be amplified linearly, just like an audio spectrum, in order to prevent excessive distortion. For this reason, Class C r-f amplifiers, like those used to amplify AM signals, cannot be used to amplify SSB signals.

To recover the audio information from the SSB signal at the receiver, the signal must be mixed with a carrier frequency which is generated at the receiver. The difference-frequency output of the mixer is the audio spectrum. In SSB receivers, the mixer that performs this demodulation is called a product detector. The product detector is described in more detail in paragraph 5.C(2).



SSB and AM Signal Spectrums
Figure 2

5. OPERATION.

A. General.

The following paragraph contains a general explanation of Airborne SSB Transceiver 618T-( ). Detailed explanations of each module are contained in paragraphs C through O.

(1) Transmit Mode.

Refer to the upper part of figure 3. The audio output of the operator's microphone is fed through two audio amplifiers, A9Q1 and A9Q2. If the balanced audio input or CW tone input is used, an additional amplifier, A9Q8, is added. A sidetone output is provided from A9Q2 for monitoring the audio. The amplified audio is fed to a balanced modulator where it is combined with a 500-kc signal from the r-f oscillator. The balanced modulator output is the upper and lower sidebands, one on each side of 500 kc. The two sidebands are fed to A3Q1, the automatic load control (alc) amplifier. The gain of the alc amplifier is controlled by a feedback signal from the grid of the power amplifier. If the grid of the power amplifier is overdriven, the gain of the alc amplifier is reduced.

The two sidebands are further amplified by A3Q2, and fed through one of two mechanical filters, A3FL1 or A3FL2. The selection of the desired filter is controlled by the mode selector switch on Control Unit 714E-( ). One filter passes only the upper sideband, and the other passes only the lower sideband. When the transceiver is operated in the AM mode, the upper sideband is passed and a 500-kc carrier from the r-f oscillator is reinserted at the filter output.

The output of the mechanical filter is fed to 500-kc i-f amplifier A3Q4 through relay A3K5. The gain of A3Q4 is controlled by feedback signals from the plate of the power amplifier. If excessive plate current flows, the transmitter gain control (tgc) reduces the gain of A3Q4. If excessive r-f plate voltage swing occurs, the automatic drive control (adc) reduces the gain of A3Q4.

The 500-kc i-f output of A3Q4 is heterodyned by mixers A12V1, A12V2, and A12V3 to the selected operating frequency. The operating-frequency output of mixer A12V3 is fed through an r-f amplifier, A12V4 and A12V5, and then through a driver, A12V6 and A12V7. The driver output goes to the linear power amplifier, A11V1 and A11V2. The amplifier output network is automatically tuned by a servo loop and fed to a 52-ohm output.

(2) Receive Mode.

Refer to the lower part of figure 3. The antenna signal is coupled to an r-f amplifier, A12V4 and A12V5. The r-f output of the r-f amplifier is heterodyned by mixers A12V12, A12V9, and A12V8 to a 500-kc i-f. The 500-kc i-f output of mixer A12V8 is fed to both SSB and AM i-f amplifiers. The AM i-f amplifiers are operating in both the SSB and AM modes to provide a Selcal (selective calling) output in either mode.

In the SSB mode, the output of the l-f mixer, A12V8, is fed to a 500-kc i-f amplifier, A3Q2, and then through one of two mechanical filters. Each filter has a bandwidth of 3 kc. One filter passes the upper sideband, and the other passes the lower sideband. The appropriate filter is selected at the mode selector switch on Control Unit 714E-( ). The filter output is amplified by i-f amplifiers A3Q3, A3Q4, and A3Q5. The output of A3Q5 is fed to a product detector which recovers the audio signal.

In the AM mode, the output of the l-f mixer, A12V8, is fed to a 500-kc i-f amplifier, A9Q3, and through a mechanical filter. This filter has a bandwidth of 6 kc in order to pass both sidebands. The filter output is amplified by i-f amplifiers A9Q4, A9Q5, and A9Q6. The output of A9Q6 is fed to an AM detector, which recovers the audio signal. Part of the output of i-f amplifier A9Q5 is amplified, detected, filtered, and fed to i-f amplifiers A9Q3 and A9Q4 for agc.

In either the SSB or AM mode, the detected audio is amplified by A9Q8, A9Q1, and A9Q2. Part of the output of audio amplifier A9Q2 is rectified and applied to r-f amplifier, A12V4 and A12V5, receive l-f mixer, A12V12, and SSB i-f amplifiers A3Q2 and A3Q3 for agc. the output of A9Q2 is fed to the operator's headphones.

B. Frequency Generation and Stabilization.

Airborne SSB Transceiver 618T-( ) transmits and receives on every 1-kc step from 2.000 to 29.999 mc. This provides 28,000 separate operating frequencies. The operating frequency is selected at Control Unit 714E-( ). The 100-kc, 10-kc and 1-kc frequency selector knobs on the control unit control the Autopositioner in the r-f translator module. The Autopositioner mechanically tunes a vfo (variable frequency oscillator) over the range from 3.500 to 2.501 mc in 1000 1-kc steps. The megacycle frequency selector knob on the control unit controls a motor in the r-f translator module. This motor switches tuning elements which tune an h-f oscillator to 28 frequencies, each 1 mc apart. The h-f oscillator, in conjunction with a 17.5-mc oscillator, provides 28 1-mc bands for each of the 1000 1-kc steps from the vfo. Thus, 28,000 steps are generated.

The extremely high stability of the 618T-( ) operating frequency is obtained by basing the frequency scheme of the entire transceiver on the frequency of a very stable crystal oscillator in the r-f oscillator module.

The injection frequency sources of the heterodyning mixers (h-f and 17.5-mc oscillators and vfo) are phase locked to the crystal-generated reference frequency by the action of circuits in the kilocycle and megacycle frequency stabilizer modules. The i-f injection frequency is also derived from the crystal oscillator. Therefore, the 618T-( ) operating frequency is as stable as the crystal oscillator, which is accurate to within 0.8 part-per-million per month.

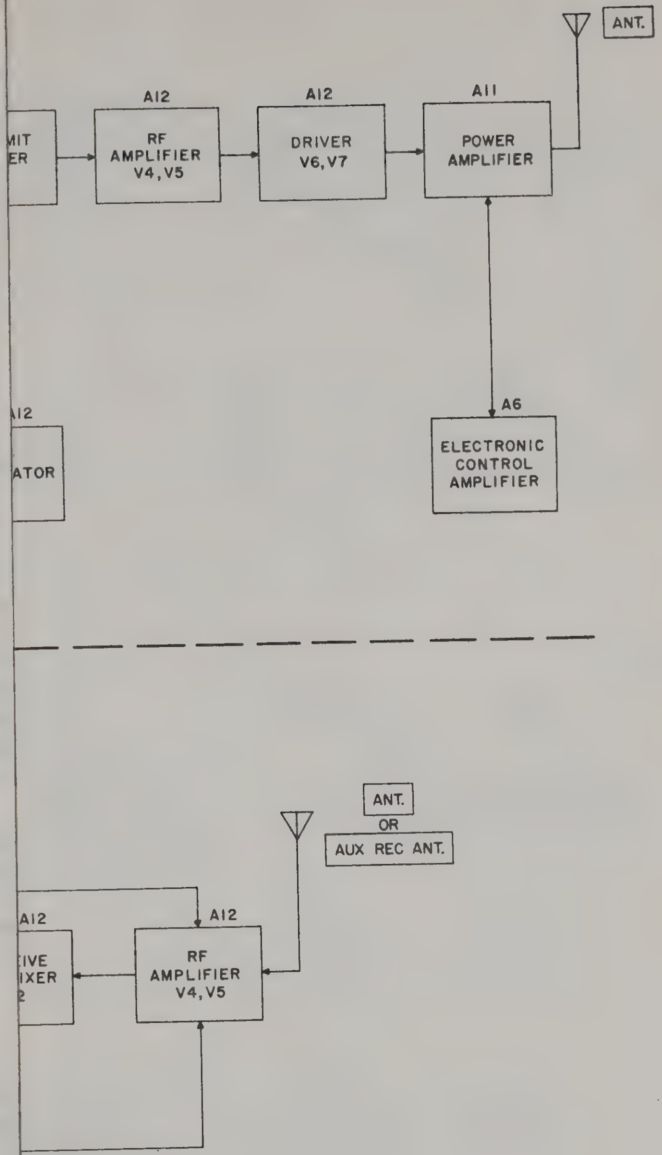
C. AM/Audio Amplifier Module, A9.

The AM/audio amplifier module (1) provides audio amplification in both the transmit and receive modes, (2) provides AM i-f amplification in the receive mode, (3) provides agc amplification and rectification, and (4) provides CW keying in the CW transmit mode. Figure 1101 is a schematic diagram of the AM/audio amplifier module.

(1) Transmit Mode.

Refer to figure 4. The audio amplifier has three possible inputs: a 100-ohm unbalanced microphone input, a 600-ohm balanced audio input (for data), and a 1000-cycle tone input from the frequency divider module. This tone input is used during CW transmission and during the antenna tuner tuning cycle.

If an unbalanced microphone is used, the input signal is amplified by Q1 and Q2 before going to the balanced modulator in the i-f translator module. If the balanced input or



3 Transceiver 618T-( ),
ock Diagram
Figure 3

In the AM mode, the output of the l-f mixer, A12V8, is fed to a 500-kc i-f amplifier, A9Q3, and through a mechanical filter. This filter has a bandwidth of 6 kc in order to pass both sidebands. The filter output is amplified by i-f amplifiers A9Q4, A9Q5, and A9Q6. The output of A9Q6 is fed to an AM detector, which recovers the audio signal. Part of the output of i-f amplifier A9Q5 is amplified, detected, filtered, and fed to i-f amplifiers A9Q3 and A9Q4 for agc.

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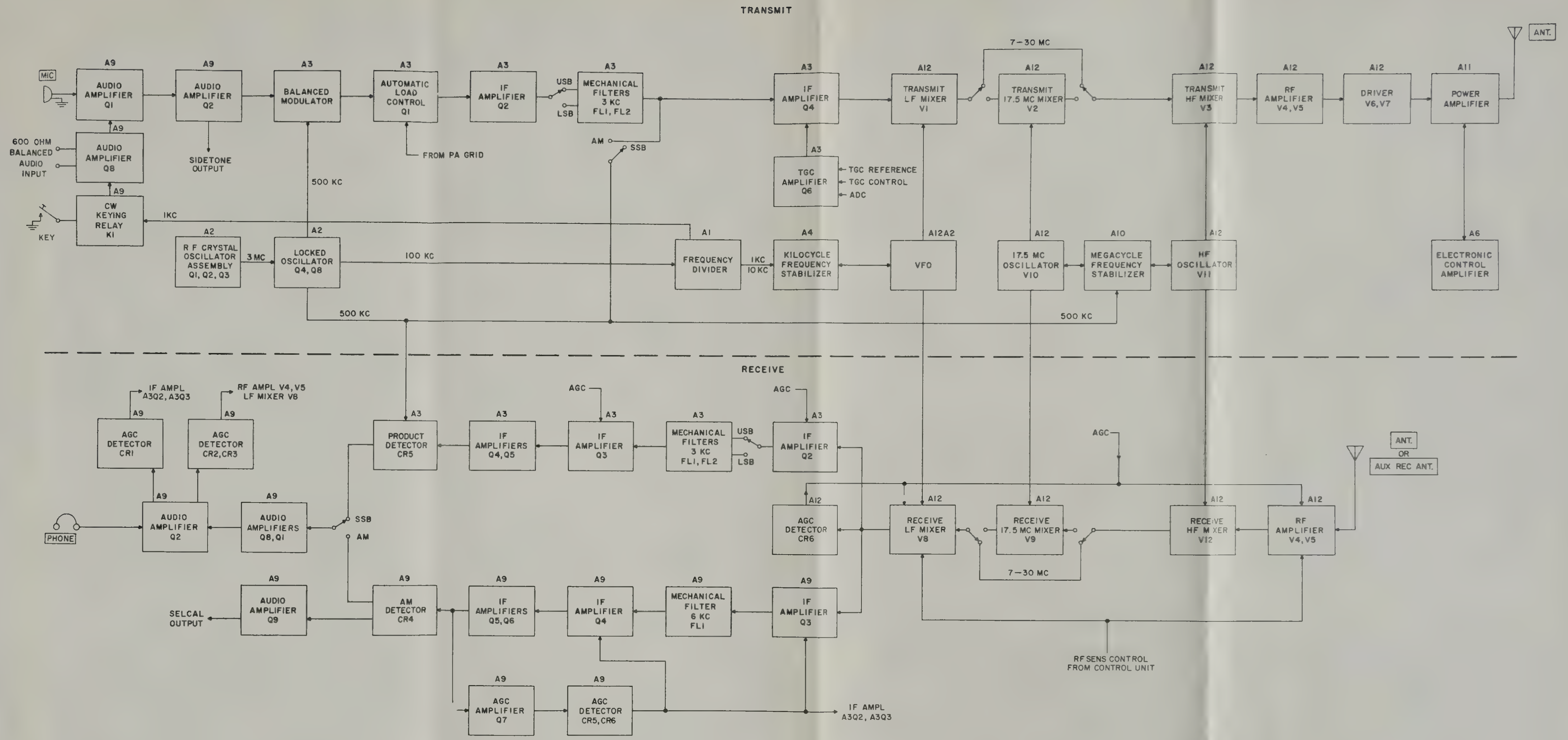
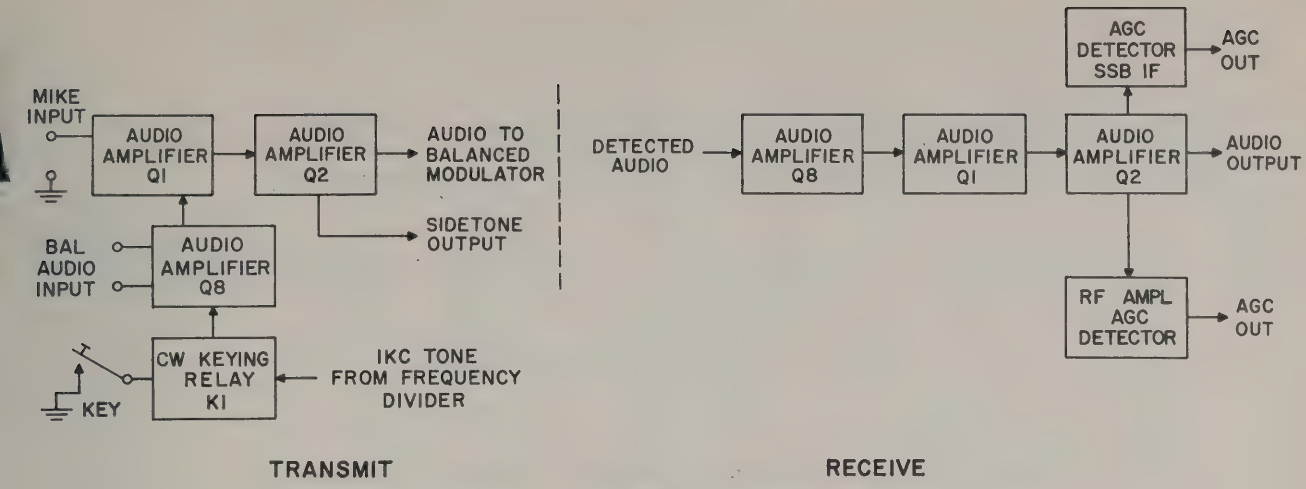
If an unbalanced microphone is used, the input signal is amplified by Q1 and Q2 before going to the balanced modulator in the i-f translator module. If the balanced input or



Airborne SSB Transceiver 618T-( ),
Block Diagram
Figure 3



Audio and CW Portion of AM/Audio Amplifier Module, Block Diagram
Figure 4

tone input is used, the input signal is amplified by Q8, Q1, and Q2 before going to the balanced modulator. A sidetone output is taken from Q2 for monitoring the audio input.

In the CW mode, the 1000-cycle tone is keyed into the upper sideband by relay K1. Relay K2 is a keyline relay that switches the 618T-( ) from receive to transmit when the CW key is depressed. Capacitors C47 and C49, placed across the coil of K2, hold the relay in the transmit position for 350 milliseconds after the key is released. This allows for spaces between words at normal CW keying speeds.

The 1000-cycle tone input is automatically fed into the audio input whenever the antenna tuner is tuning. Thus, the operator is signaled that the tuner is operating by the 1000-cycle tone at the audio output. Resistor R57 is selected at the factory for approximately 1-mv tune tone output during tuning. The tune tone level may be varied by changing the value of resistor R57.

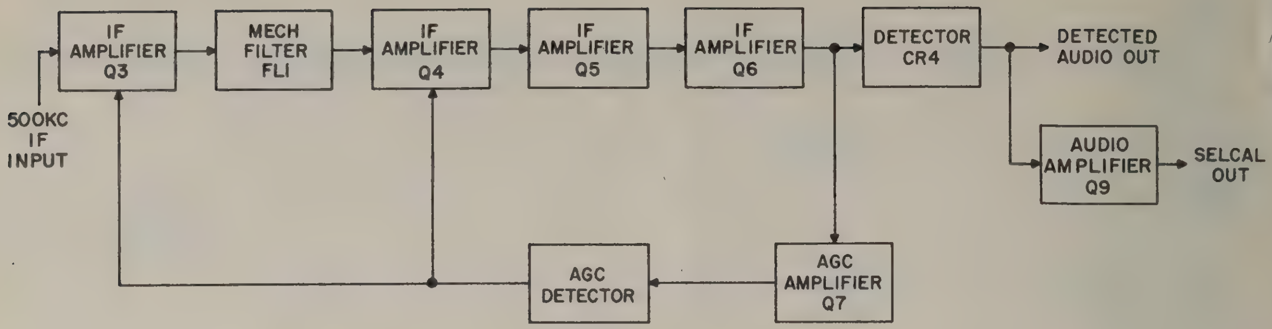
(2) Receive Mode.

The AM i-f amplifiers are operating whenever the 618T-( ) is in the receive mode to furnish a continuous selcal output.

Refer to figure 5. The 500-kc i-f input from the r-f translator module is fed to i-f amplifier Q3. The output of this amplifier is passed through a mechanical filter with a 6-kc bandwidth in order to pass both audio sidebands. The filter output is then amplified by i-f amplifiers Q4, Q5, and Q6. The output of Q6 is detected by CR4, filtered, and fed to the audio amplifier through AM/SB switching relay K3 in the i-f translator module. Part of the unswitched audio output from the AM detector is amplified by Q9 and fed to the selcal output at the rear connector.

Refer to figure 4. Three audio amplifiers, Q8, Q1, and Q2, are used in the receive mode. The audio inputs are from the AM detector in the AM mode, or from the product detector in the i-f translator module in the SSB mode.

Part of the 500-kc i-f output of Q6 goes to agc amplifier Q7. The amplifier output is rectified, filtered, and fed back to AM i-f amplifiers Q3 and Q4 for agc.



AM I-F Portion of AM/Audio Amplifier Module, Block Diagram
Figure 5

Part of the audio output of Q2 is rectified, filtered, and fed back to the r-f amplifiers, V4 and V5, and the receive l-f mixer, V8, in the r-f translator module, for agc.

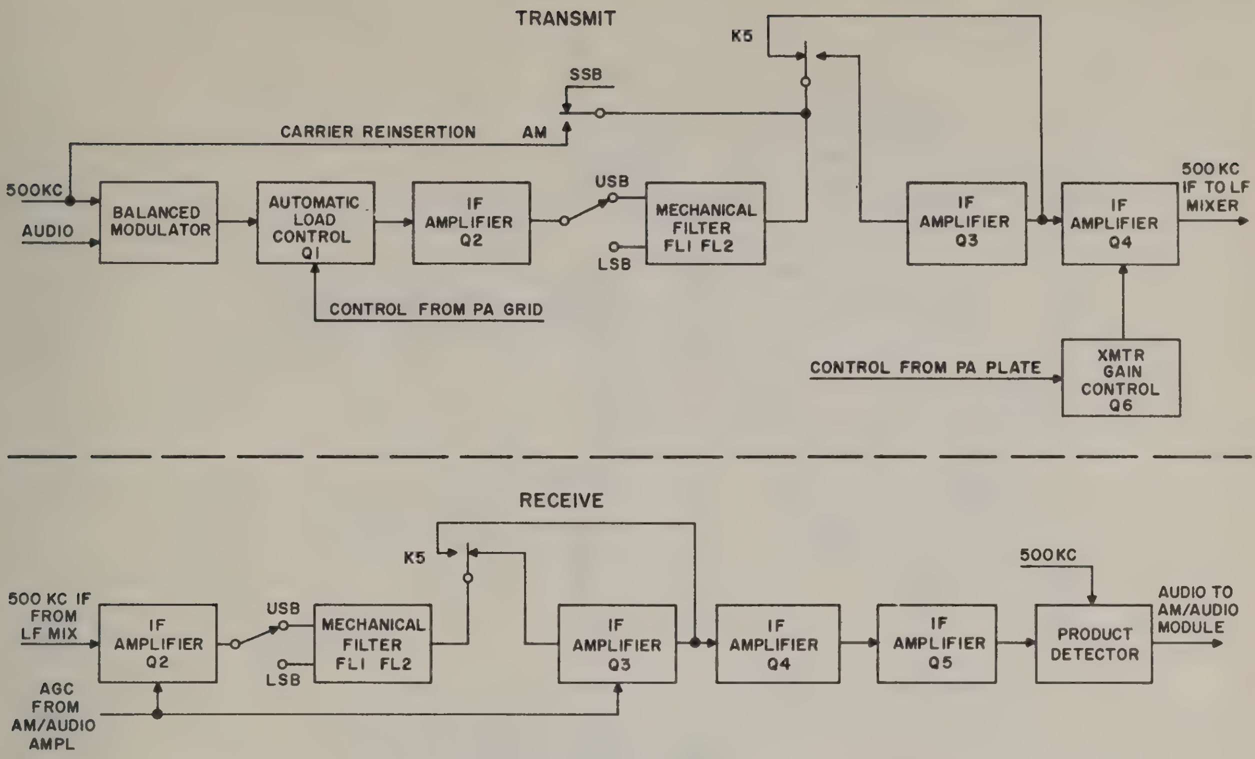
D. I-F Translator Module, A3.

The i-f translator module (1) generates a 500-kc SSB or AM signal in the transmit mode, and (2) contains SSB i-f amplifiers and product detector which are used in the receive mode. Figure 1102 is a schematic diagram of the i-f translator module.

(1) Transmit Mode.

Refer to figure 6. The amplified audio from the AM/audio amplifier module is combined with a 500-kc signal from the r-f oscillator module in the balanced modulator, CR1. Refer to figure 7. The balanced modulator is essentially a diode chopper that reverses polarity of the audio input at a 500-kc rate. The 500-kc voltage switches the diodes on and off so that the audio input follows circuits as shown in figures 7(A) and 7(B) on successive half cycles. The 500-kc switching voltage is approximately 10 times larger than the audio, so that audio voltage peaks will not switch the diodes.

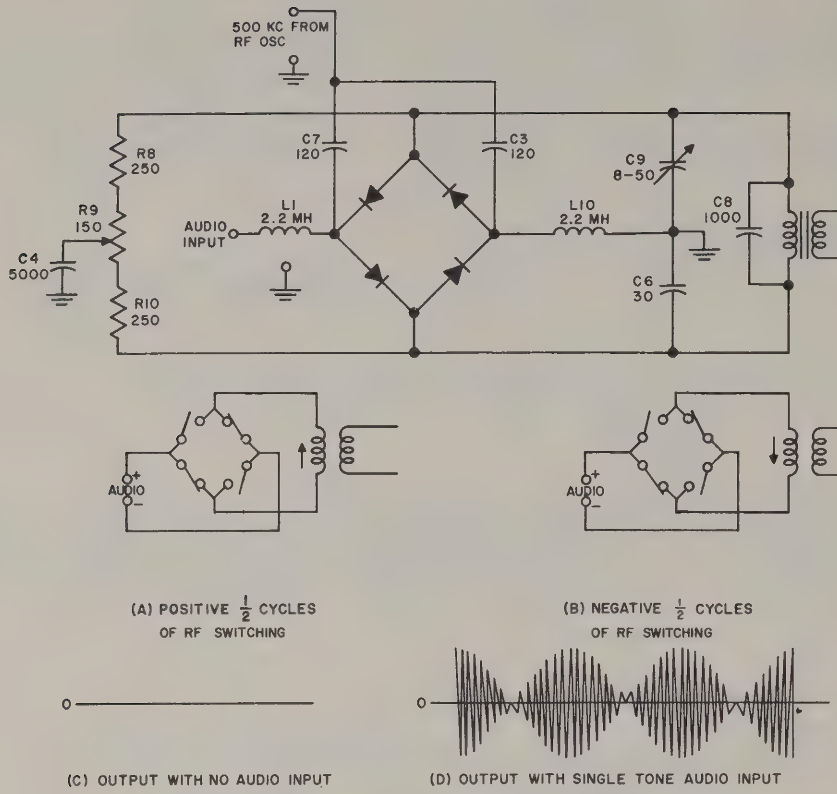
The switching action of the diodes causes equal 500-kc currents to flow in opposite directions through the primary of T1. The sum of the equal, opposite currents in the winding is zero. Therefore, the 500-kc carrier component has been balanced out of the modulator output. The diodes in the modulator circuit are matched so that the forward resistances of the diodes in the two on-biased conditions, 7(A) and 7(B), are equal. R9 and C9 are adjustable so that the currents can be balanced even more closely to ensure that the currents flowing through the diodes on successive half cycles will be equal. C6 and C9 overcome the effects of distributed capacitance in the modulator circuit. The balanced modulator output with a single-tone audio input is shown in figure 7(D).



I-F Translator Module, Block Diagram
Figure 6

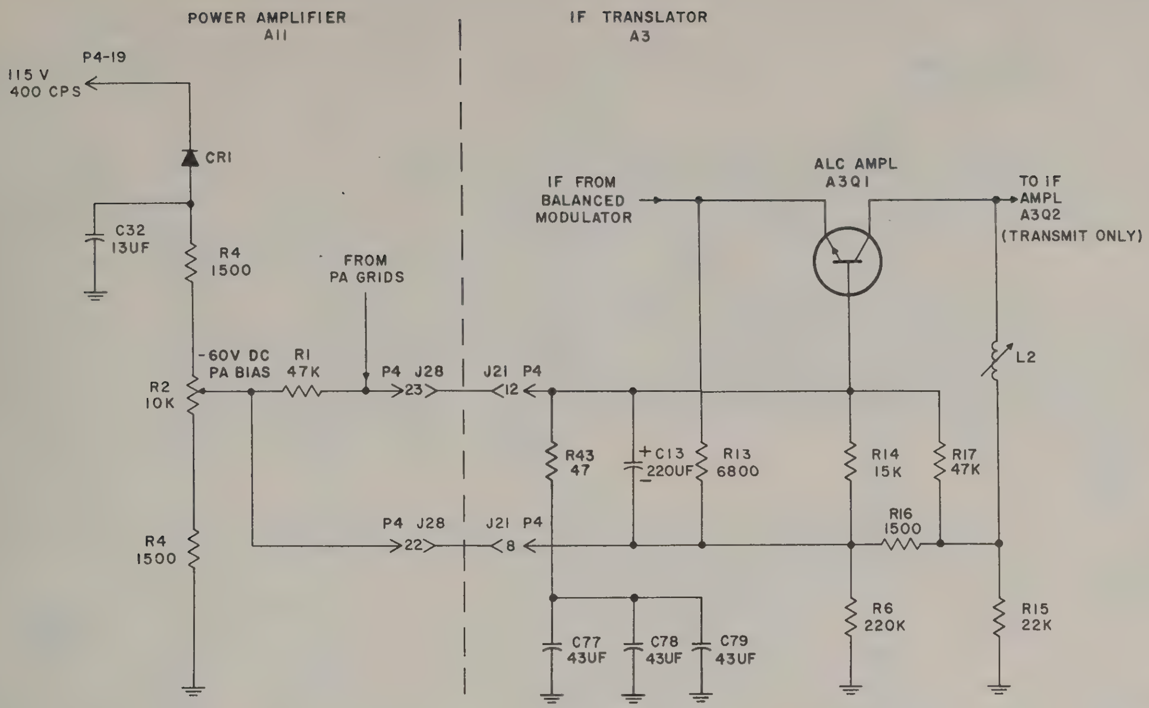
The balanced modulator output is fed through T1 to an automatic load control (alc) amplifier, Q1. Refer to figure 8. The alc amplifier is biased by voltages taken from the power amplifier bias supply in the power amplifier module. Resistor R1 in the power amplifier module is common to the grid circuit of the power amplifiers and the emitter-base circuit of the alc amplifier. When the grids of the power amplifier are overdriven, grid current will flow through R1. The voltage drop across R1 reduces the emitter current in the alc amplifier. This, in turn, decreases the amplifier gain and reduces the drive to the power amplifier. Thus, the power amplifier grid drive is kept at its maximum possible level without grid current flowing. Capacitor C13, across R1, provides fast attack-slow release action for the alc circuit.

The alc amplifier output is further amplified by i-f amplifier Q2 and fed to sideband relay K2. This relay, controlled by the mode selector switch at the control unit, switches the double sideband signal so that it passes either through the upper sideband (USB) filter, FL1, or the lower sideband (LSB) filter, FL2. When the mode selector switch is in the AM position, the USB filter is used and a 500-kc carrier frequency is reinserted at the filter output. The sideband signal then passes through contacts 8 and 3 of relay K5 and applied to the input of i-f amplifier Q4. Relay K5 is energized by the transmit-receive relay control and is energized in the transmit mode. The relay is used to bypass the sideband signal around i-f amplifier Q3 since the additional amplification provided by Q3 is not required in the transmit mode. I-f amplifier Q4 is the transmitter gain control (tgc) and automatic drive control (adc) stage.



Balanced Modulator, Simplified Schematic Diagram
Figure 7

Refer to figure 9. The gain of the tgc stage Q4, is controlled by the output of a d-c amplifier, Q6. Transistor Q6 has two inputs. One input is from the high-voltage power supply module. This negative voltage is proportional to the power amplifier plate current, which is drawn from the high-voltage power supply. The other input to Q6 comes from the power amplifier module and is proportional to the power amplifier r-f plate voltage swing. The level of this signal is adjusted so that a d-c voltage is present at the base of transistor Q6 only when the r-f plate voltage swing is excessive due to an open circuit at the output of the transmitter. If the power amplifier plate current tends to increase, or the r-f plate swing exceeds a preset value, the forward emitter-base voltage of tgc-adc amplifier Q6 is decreased causing the collector current to decrease. This collector current flows through resistors R27 and R28, which are common to the collector circuit of the tgc amplifier, Q6, and the emitter-base circuit of i-f amplifier Q4. When collector current decreases in Q6, the voltage across R22 and R28 decreases. This reduces the emitter current in Q4, and, thus, reduces its gain. This feedback action keeps the power amplifier plate current and r-f plate voltage swing from exceeding certain preset values.



ALC Circuit, Simplified Schematic Diagram
Figure 8

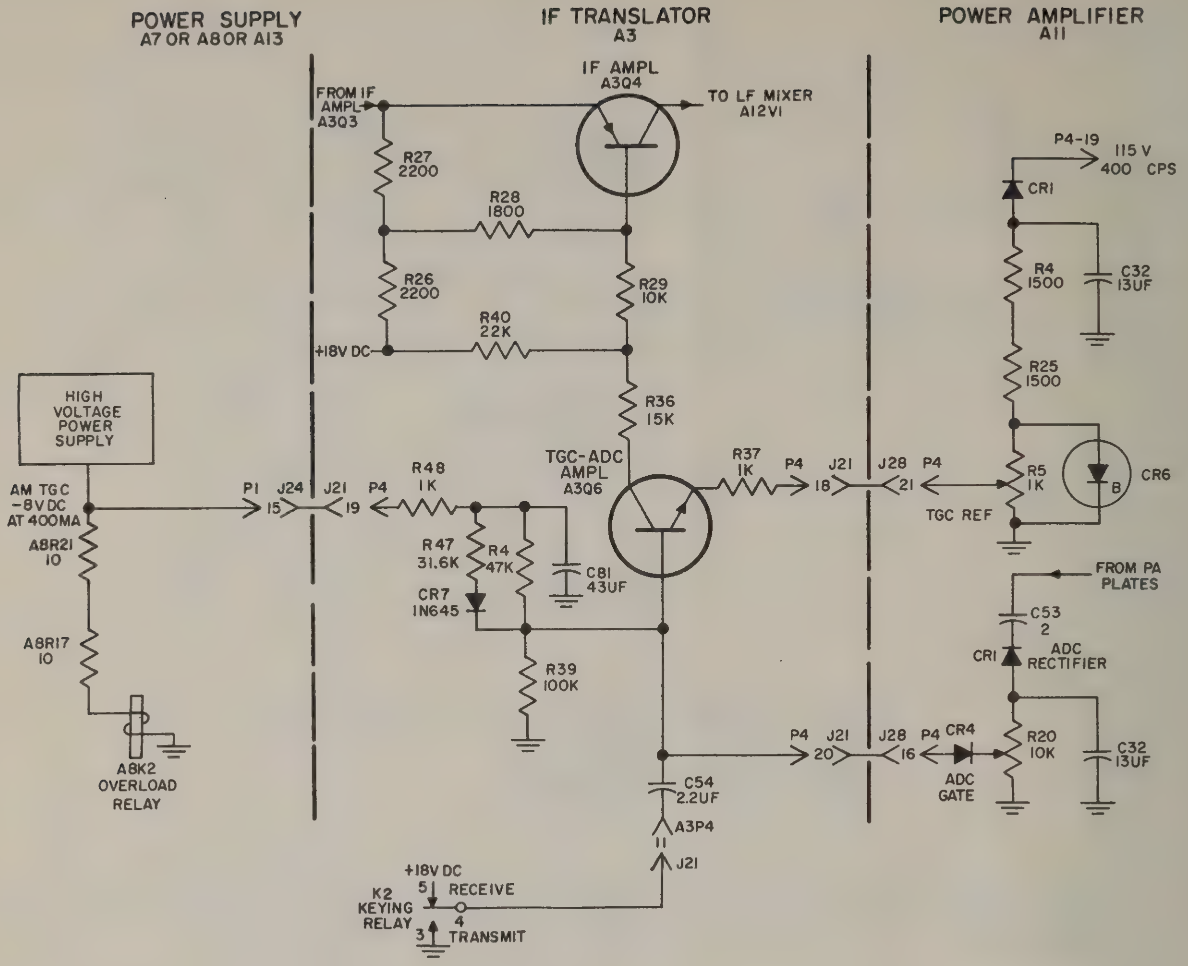
The tgc reference adjust, R5 in the power amplifier module, controls the transmitter power output. It is adjusted for approximately 100 watts into a 52-ohm load in the AM mode.

A protective circuit in the i-f translator module is used to prevent overdriving the transmitter before its gain control circuits are stabilized. An RC circuit, consisting of C54 and R39, gradually increases the transmitter gain from a low value to its normal value when the transmitter is keyed. Refer to figure 9. Capacitor C54, which is connected to the base of Q6, is charged through R39 to 18 volts when the 618T-( ) is in the receive mode. When the transmitter is keyed, C54 discharges through R39. This places a negative voltage on the base of Q6, cutting off the transistor at the instant the transmitter is keyed. As C54 discharges, the base of Q6 becomes less and less negative, until finally the input is forward biased and the amplifier is operating normally. The discharge time of the circuit is approximately 100 milliseconds.

(2) Receive Mode.

Refer to figure 6. The 500-kc i-f SSB signal from the r-f translator module is fed through i-f amplifier Q2 to the sideband mechanical filters. The filter that passes the sideband being received is switched into the circuit at the control unit. The filter output is further amplified by i-f amplifiers Q3, Q4, and Q5, since relay K5 is de-energized in receive mode, and then fed to the product detector.

The product detector is a diode mixer that mixes the 500-kc i-f sideband from Q5 with a 500-kc signal from the r-f oscillator module. The difference-frequency output of this



TGC and ADC Circuits, Simplified Schematic Diagram
Figure 9

mixer is the audio signal. A low-pass filter at the product detector output filters out the higher-order mixer products. The product detector output is fed through AM/SB switching relay K2 to the audio amplifier in the AM/audio amplifier module.

The gain of i-f amplifiers Q2 and Q3 is controlled by an agc voltage that is a combination of voltages from two sources. Part of this agc voltage comes from the i-f agc detector in the AM/audio amplifier module. The other part comes from the audio agc detector in the same module. Thus, the i-f amplifiers in the i-f translator module receive both i-f and audio agc from the AM/audio amplifier module.

E. R-F Translator Module, A12.

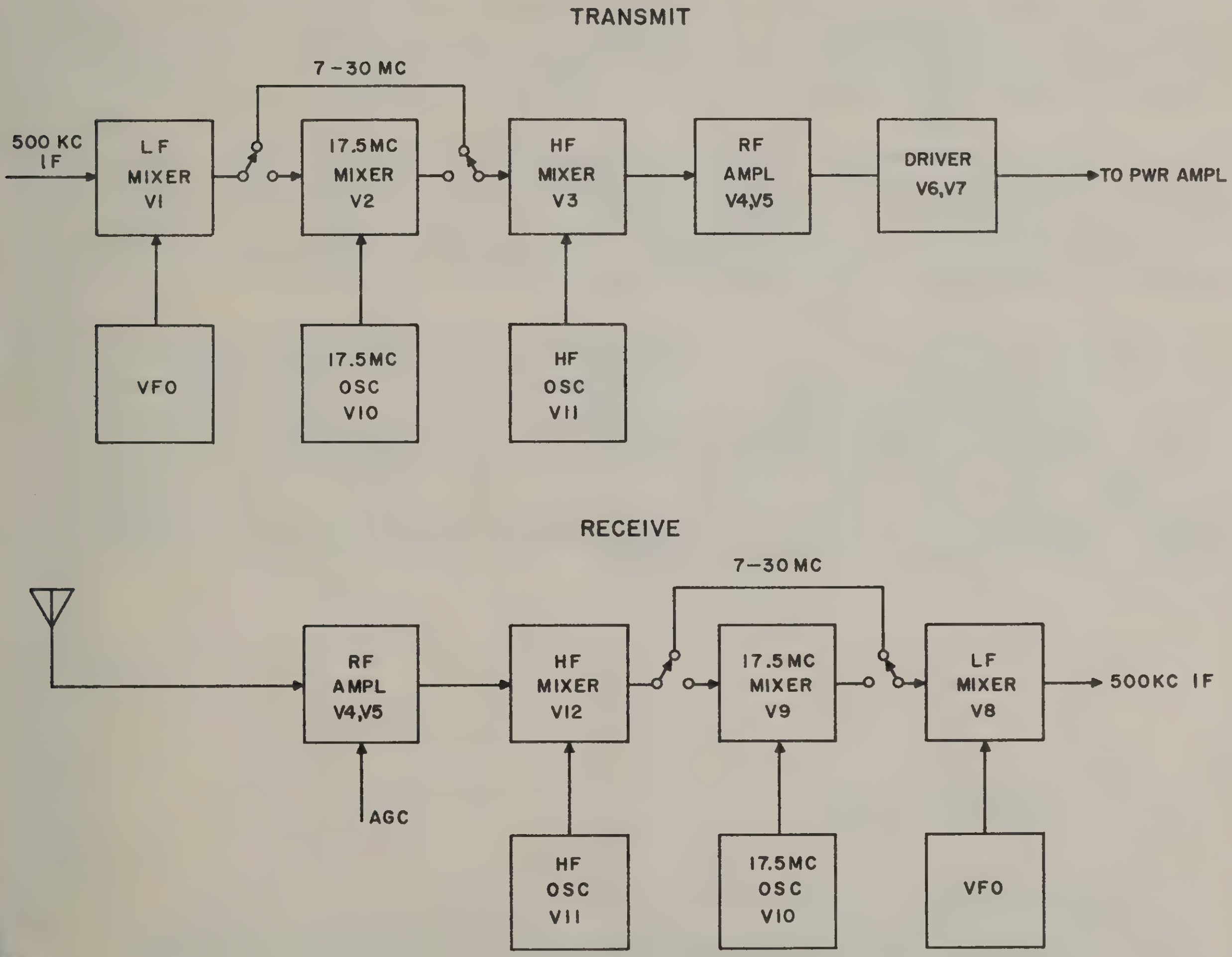
The r-f translator module (1) translates the 500-kc i-f signal from the i-f translator module to the selected r-f operating frequency in the transmit mode, and (2) translates the r-f

antenna signal to a 500-kc i-f signal in the receive mode. The Autopositioner and variable frequency oscillator (vfo) submodules are contained in this module. Figure 1103 is a schematic diagram of the r-f translator module.

(1) Transmit Mode.

Refer to figure 10. The 500-kc i-f signal from the i-f translator module is combined with the vfo output in the transmit l-f mixer, V1. The vfo frequency varies from 3.500 to 2.501 mc in 1000 1-kc steps. Thus, the difference-frequency output of the l-f mixer varies from 2 to 3 mc in 1000 1-kc steps.

If the operating frequency is to be from 2.000 to 6.999 mc, the output of the l-f mixer is mixed with a 17.5-mc signal from the 17.5-mc oscillator, V10, in the transmit 17.5-mc mixer, V2. The 14.5- to 15.5-mc output of this mixer is then fed to the transmit h-f mixer, V3. If the operating frequency is to be from 7.000 to 29.999 mc, the output of the l-f mixer is fed directly to the h-f mixer.



R-F. Translator Module, Block Diagram
Figure 10

The h-f mixer has 28 injection frequencies, spaced 1 mc apart. These 28 frequencies provide 28 bands for the 1000 steps from the vfo, making 28,000 channels available. The injection frequencies are generated by the h-f oscillator, V11. The h-f oscillator oscillates at only 16 fundamental frequencies, every 500 kc from 8.0 to 16.5 mc. To get the 28 frequencies, the oscillator output is tuned, in some cases, to twice the fundamental. The injection frequencies from the h-f oscillator for the 28 bands are tabulated in table 7.

The output of the h-f mixer is fed to the r-f amplifier, V4 and V5 connected in parallel, and then to the driver, V6 and V7 connected in parallel. The driver output is fed to the power amplifier module for amplification to the output power level.

The h-f oscillator, h-f mixer, r-f amplifier, and driver are tuned by the bandswitch motor, B1. This motor bandswitches tuning elements to 28 positions, one for each band. B1 is controlled by the megacycle selector knob at the control unit.

(2) Receive Mode.

The antenna signal is fed to the r-f amplifier, V4 and V5 connected in parallel. The amplifier output then goes through the receive h-f and l-f mixers, V12 and V8, and, if the received signal is from 2.000 to 6.999 mc, through 17.5-mc mixer V9. The tuned circuits of these receive mixers are the same circuits that tune the transmit mixers.

The r-f amplifier and l-f mixer receive agc voltage, which is derived from the rectified, filtered audio output. In addition to this audio agc, the amplifier and mixer are fed carrier agc, which is derived from the rectified, filtered r-f output of the l-f mixer. The 500-kc i-f signal output from the receive l-f mixer is fed to the i-f translator and AM/audio amplifier modules for both SSB and AM i-f amplification and detection.

The frequencies of the 17.5 and h-f oscillators are phase locked with the crystal-generated reference frequency from the r-f oscillator module by the action of circuits in the megacycle frequency stabilizer module. These oscillators are tuned by voltage-sensitive capacitors. Voltage-sensitive capacitors are semiconductor devices whose capacitance varies as the d-c voltage across them varies. A typical relationship between capacitance and d-c voltage is shown in figure 11. To obtain a linear relationship between capacitance and voltage, a d-c bias voltage is applied to the device and the voltage across it is varied by only a small amount.

(3) Autopositioner Submodule, A12A1.

(a) General.

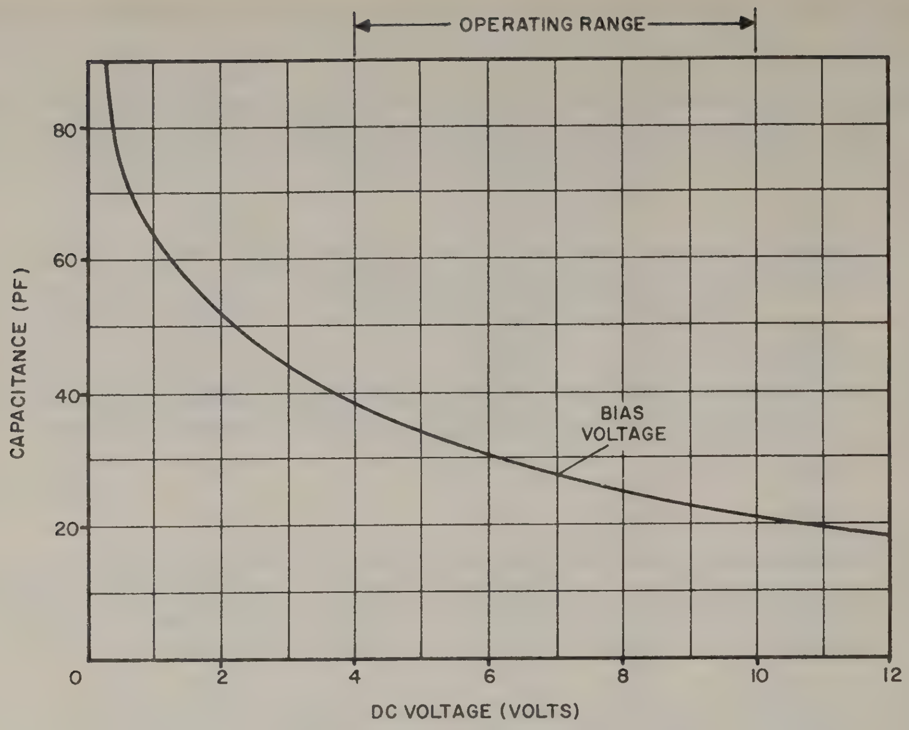
The Autopositioner is a motor-driven, electrically-controlled tuning mechanism. This mechanism automatically tunes the 618T-( ) to the frequency selected at the remote control unit. Thus, the 618T-( ) may be located, for example, in the radio compartment of the aircraft, and be completely controlled from a remote unit which is on or near the aircraft instrument panel.

TABLE 7. H-F OSCILLATOR FREQUENCY FOR EACH OPERATING FREQUENCY RANGE

OPERATING FREQUENCY (MC)	H-F OSCILLATOR FREQUENCY (MC)
2-3	12.5*
3-4	11.5*
4-5	10.5*
5-6	9.5*
6-7	8.5*
7-8	10.0
8-9	11.0
9-10	12.0
10-11	13.0
11-12	14.0
12-13	15.0
13-14	16.0
14-15	8.5**
15-16	9.0**
16-17	9.5**
17-18	10.0**
18-19	10.5**
19-20	11.0**
20-21	11.5**
21-22	12.0**
22-23	12.5**
23-24	13.0**
24-25	13.5**
25-26	14.0**
26-27	14.5**
27-28	15.0**
28-29	15.5**
29-30	16.0**

*These h-f oscillator frequencies are mixed with the 14.5- to 15.5-mc output from the 17.5-mc mixer.

**These h-f oscillator frequencies are doubled before injection into the h-f mixer.

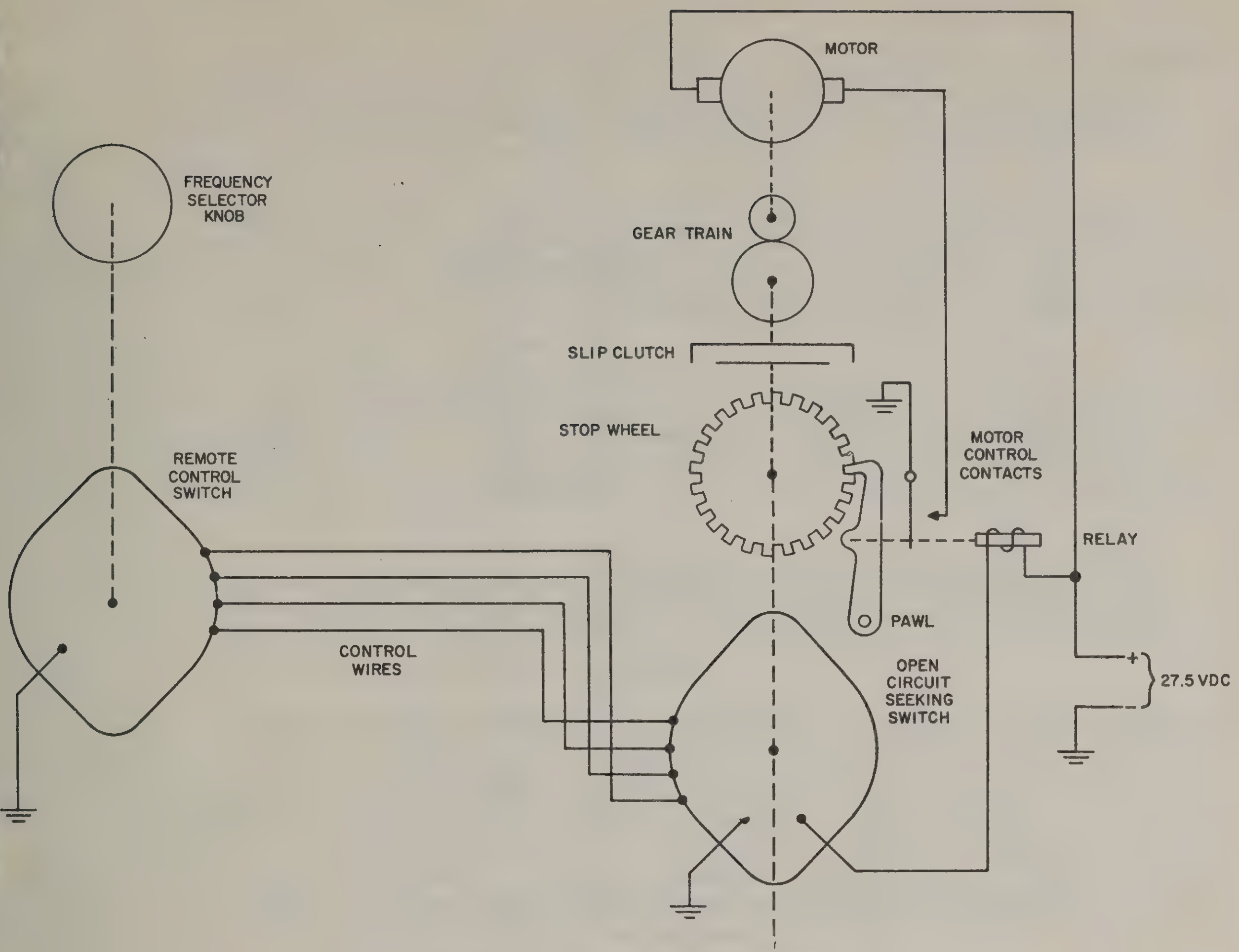


Voltage-Sensitive Capacitor, Typical Characteristics
Figure 11

The basic elements of the Autopositioner system are shown in figure 12. These elements are a motor and its gear reduction train, a slip clutch driving a rotary shaft, which is fastened to a notched stop wheel, a pawl which engages the notches in the stop wheel, and a relay which controls the pawl and operates a set of electrical contacts to start and stop the motor.

An electrical control system is part of each Autopositioner system. This control system consists of remotely-located control switches and electrically-similar seeking switches that are driven by the Autopositioner shaft. The control system is the open-circuit seeking type. Whenever the control switches and seeking switches are not set to the same electrical position, the Autopositioner is energized and drives its shaft (and the tuning elements to which the shaft is coupled) to the proper position to restore the symmetry of the control system.

A typical cycle of operation of the Autopositioner is as follows. The system is originally at rest with the control and seeking switches in corresponding positions (open circuit), relay in the de-energized position, pawl engaging a stop-wheel notch, and the motor not energized. When the operator changes the setting of the remote control frequency selector switch, the control system energizes the relay, lifting the pawl out of the stop-wheel notch and closing the motor control contacts. The motor starts, driving the Autopositioner shaft, the rotor of the seeking switches, and the tuning elements in tuned circuits. When the seeking switch reaches the point corresponding to the new position of the control switch, the relay circuit is opened and the pawl is dropped into a stop-wheel notch to stop shaft rotation. The motor



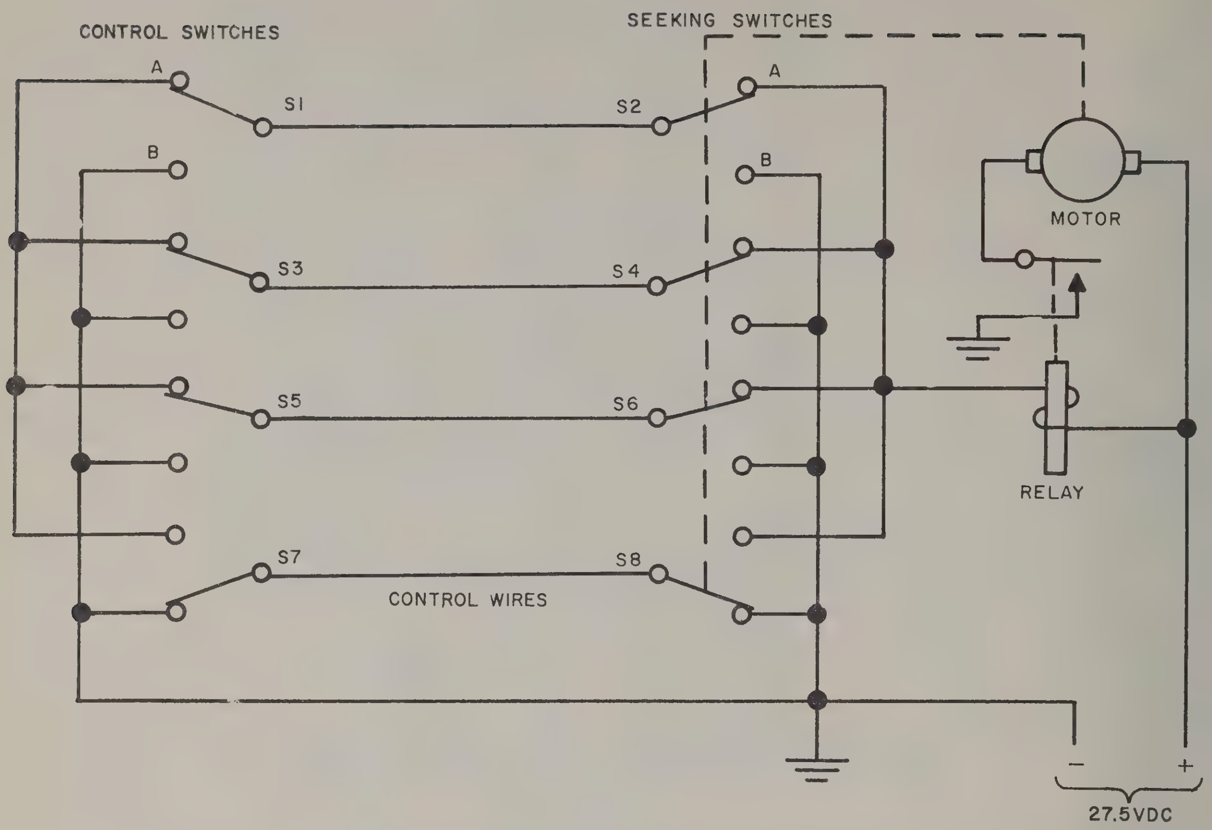
Autopositioner System, Basic Elements
Figure 12

control contacts open, and the motor coasts to a stop, dissipating kinetic energy in the slip clutch. The seeking switch of the control circuit is adjusted to open the relay circuit before the stop wheel reaches the point where the pawl engages the proper notch. The relay contacts controlling the motor are adjusted so that they do not open until the pawl drops into the notch.

(b) Autopositioner Control System.

A binary control system is used with the Autopositioner to provide a maximum number of tuning positions with a minimum number of control wires. This is done in the binary system by using the control wires in various combinations.

The binary system is like one composed of single-pole, double-throw switches as shown in figure 13. When the control and seeking switches are set symmetrically (S1 in the same position as S2, etc., as shown), there is no current path from the relay coil to ground, and the relay and motor are unenergized. If any of the control switches is set to a position opposite that of a corresponding seeking switch, a



Frequency Control System, Simplified Schematic Diagram
Figure 13

path to ground is closed, energizing the relay and motor. The motor turns the rotary seeking switches until they are again positioned in a symmetrical arrangement with the control switches. When this happens, the relay circuit opens and the motor stops.

The total number of combinations of switch positions in such a system is 2^n, where n is the number of control wires used. In the four-wire system shown, 2^4 or 16 different combinations exist. One combination, however, is not usable. If all the seeking switches in figure 13 are set to the B position, there can be no path from the relay coil to ground no matter how the control switches are set. Therefore, the maximum number of usable combinations in such a system is 2^n-1. The four-wire system shown can control 15 positions.

The control switches for the 618T-( ) Autopositioner system are contained in Control Unit 714E-( ). Figures 1105, 1106, and 1107 are schematic diagrams of th three types of control units.

Early models of Control Units 714E-1 and 714E-2 contain r-f gain control circuits that differ from those in later models. The switching arrangement in both models, however, is the same.

(c) 618T-( ) Autopositioner.

The output shaft of the 618T-( ) Autopositioner is mechanically coupled to a variable inductor in the tuned circuit of the vfo. Ten turns of the output shaft tune the vfo through a 1-megacycle frequency range. Figure 1104 is a schematic diagram of the 618T-( ) Autopositioner submodule.

There are three seeking switches in the 618T-( ) Autopositioner system: the 100-kc, 10-kc, and 1-kc seeking switches. For the selected vfo frequency to be set up, all three seeking switches must be satisfied. Since each of the three switches has 10 positions, there are 10^3 or 1000 possible switch combinations or shaft positions.

The 100-kc seeking switch is geared to the output shaft by an intermittent movement so that it is moved one position for each revolution (100 kc) of the output shaft. The 10-kc seeking switch and stop wheel are coupled directly to the output shaft. The stop wheel has 10 notches, making each notch position 10 kc apart in frequency. The 100-kc and 10-kc seeking switches are both driven by the same motor, B2.

The 1-kc seeking switch is driven by a separate motor, B1. This motor also drives a gear and cam arrangement that turns the output shaft to 10 intermediate positions between each notch on the stop wheel. Each of the 10 positions is a 1-kc step. These 10 positions, together with the 100 notch positions furnished by the 10 revolutions of stop wheel, give the required 1000 positions.

The Autopositioner mechanically tunes the vfo to within 2 kc of the selected operating frequency by the Autopositioner. The vfo is phase locked with the crystal-generated reference frequency from the r-f oscillator module by the action of circuits in the kilocycle frequency stabilizer module. Precision resistive dividers, which are ganged to the seeking switches in the Autopositioner submodule, furnish voltage information to the stabilizing circuits so that they will phase lock the vfo at the correct 1-kc frequency. As in the case of the 17.5 and h-f oscillators in the r-f translator module, the vfo is tuned by a voltage sensitive capacitor.

(4) Variable Frequency Oscillator Submodule, A12A2.

The frequency of the variable frequency oscillator (vfo) is controlled, through the Autopositioner, by the 100-, 10-, and 1-kc knobs on the control unit. It is tuned in 1000 1-kc steps from 3.500 to 2.501 mc. Figure 1108 is a schematic diagram of the vfo submodule.

The oscillator in the vfo is a tuned-collector transistor oscillator, Q1. This oscillator is tuned by variable inductor L2, which is mechanically varied by the Autopositioner. It is phase locked by voltage-sensitive capacitor VC1. The d-c voltage that tunes VC1 is a combination of a mechanically-adjustable bias supply in the kilocycle frequency stabilizer module and a frequency- and phase-sensitive control voltages. These control voltages come from frequency and phase discriminators in the kilocycle stabilizer module. After the mechanical tuning is completed, the kilocycle stabilizer supplies a d-c control voltage from the frequency discriminator to bring the vfo frequency within the capture range of the phase discriminator. The phase discriminator then superimposes a strong d-c correction voltage to override the frequency discriminator and phase lock the vfo to the reference frequency from the r-f oscillator module. After the vfo is phase locked, the phase discriminator constantly changes the control voltage to VC1, if necessary, to keep the vfo frequency phase locked with the reference.

The vfo output goes through three amplifiers, Q2, Q3, and Q4, before it is coupled through transformer T2 to the l-f mixers in the r-f translator.

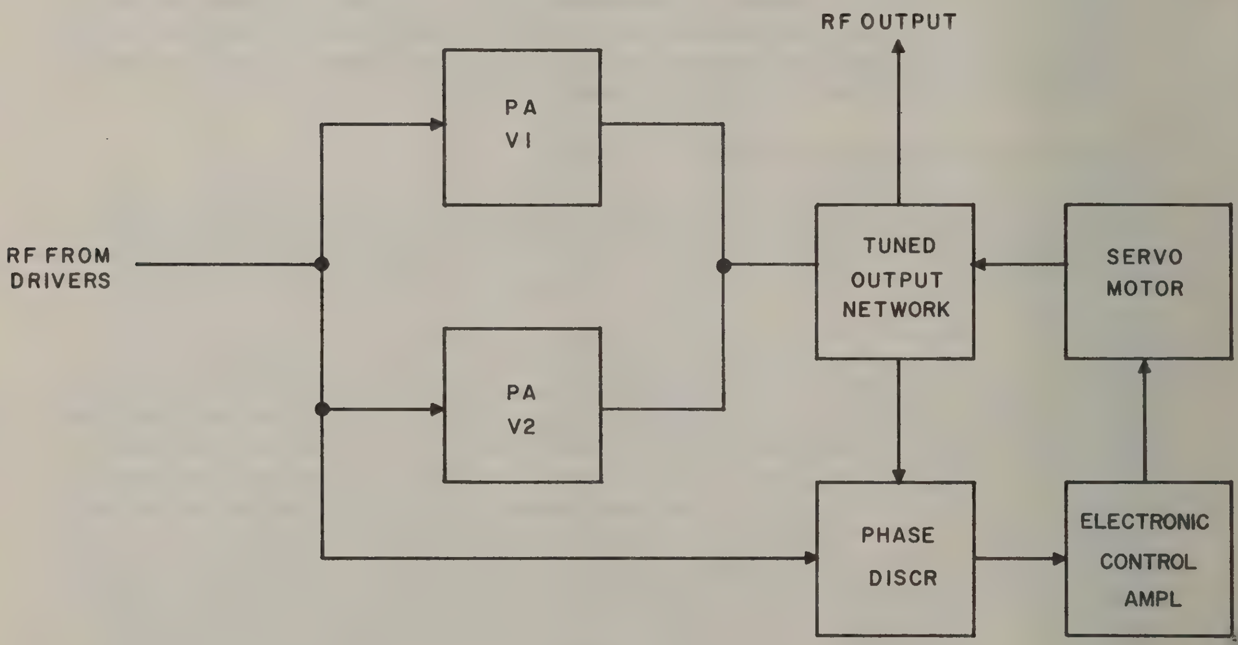
Figure 1123 is a schematic diagram of vfo's used in early models of the 618T-( ). This model (70K-3) does not include the third amplifier, Q4. It also differs from the 70K-5 in the manner in which it receives tuning voltage from the kilocycle stabilizer module. Thus, the 70K-3 and 70K-5 are not electrically interchangeable, and each must be used with the proper kilocycle stabilizer module.

F. Power Amplifier and Electronic Control Amplifier Modules, A11 and A6.

The power amplifier module amplifies the 2- to 30-megacycle output of the r-f translator module to 400 watts PEP in the SSB mode or 100 watts carrier power in the AM or CW modes. Figure 1109 is a schematic diagram of the power amplifier module.

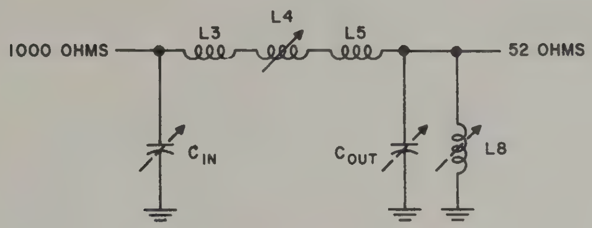
Refer to figure 14. The r-f signal from the r-f translator module is applied to the grids of the linear power amplifier, V1 and V2 connected in parallel. The power amplifier output network is a pi-section that steps up the 52-ohm antenna impedance to a 1000-ohm load for the power amplifier.

Refer to figure 15. The shunt capacitances and part of the series inductance of the output network is switched by motor B1 to 8 discrete steps, or bands. B1 is controlled by the megacycle frequency selector knob at the control unit. Part of the series inductance in the network is a variable inductor, L4, that is varied by a servo motor, B2. The servo motor is controlled by the output of a phase discriminator, which compares the phases of the input and output signals of the power amplifier. If these signals are not 180 degrees out of phase, the

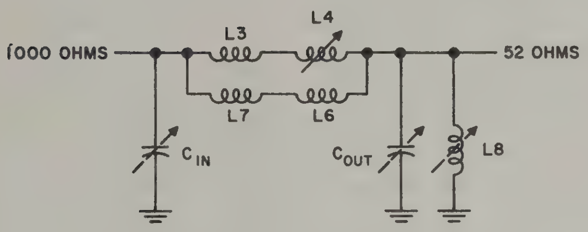


Power Amplifier Module, Block Diagram
Figure 14

phase discriminator produces a d-c output which is proportional in polarity and magnitude to the direction and magnitude of the phase error. This d-c error signal is changed to 400-cycle a-c by a mechanical chopper in the electronic control amplifier module, A6. Figure 1110 is a schematic diagram of the electronic control amplifier module. The a-c error signal is amplified in the electronic control amplifier and applied to the servo motor. The motor drives the variable inductor, L4, which tunes the output circuit until the input and output signals are 180 degrees out of phase.



(A) BANDS 1 THROUGH 3.



(B) BANDS 4 THROUGH 8.

BAND	RANGE (MC)	FREQUENCY RATIO
1	2-3	1.5 : 1
2	3-4	1.3 : 1
3	4-6	1.3 : 1
4	6-8	1.5 : 1
5	8-11	1.4 : 1
6	11-16	1.5 : 1
7	16-22	1.4 : 1
8	22-30	1.4 : 1

NOTE:
BROKEN ARROW INDICATES THAT VALUE IS VARRIED IN 8 STEPS.

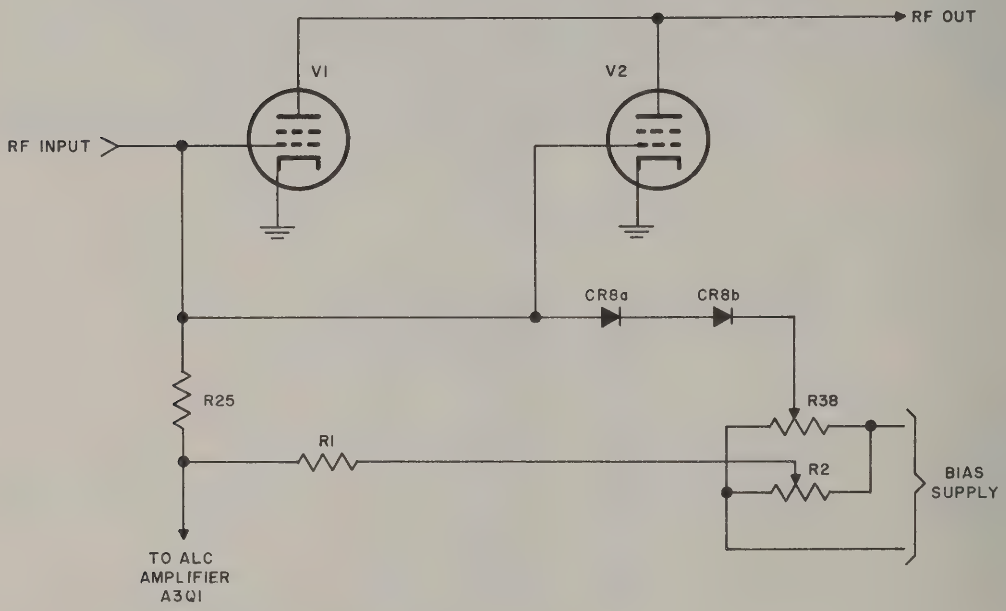
Power Amplifier Output Network, Simplified Schematic Diagram
Figure 15

On some of the 8 bands, the variable inductor is combined in series with other inductors as shown in figure 15(A). On the other bands, L4 is in a series-parallel arrangement as shown in figure 15(B). In both circuits, the inductances are chosen so that the tuning range of the output circuit never exceeds 1.7 to 1 as the variable inductor is varied from one of its

extremes to the other. All of the 8 bands have frequency ratios at their extremes that are less than 1.7 to 1. Band 1, for example, has a ratio of 3 mc to 2 mc, or 1.5 to 1. Therefore, it is in the 1.7 to 1 tuning range of the variable inductor. If the frequency ratio were allowed to reach 2 to 1, the phase discriminator would try to pick up the second harmonic of the fundamental input frequency, and the phase discriminator would not operate properly.

L8, shown in figures 15(A) and 15(B), is a compensating inductor that is tapped so that the parallel combination of L8 and C_{out} approaches resonance at the high end of the band being used. The high impedance of this parallel resonant circuit keeps the output impedance, and, therefore, the amplifier plate load, nearly constant over the entire tuning range of the band being used.

The 52-ohm output of the power amplifier module is coupled to an antenna tuner. A signal from the tuner during the tuning cycle energizes relay K3 and places two parallel 50-ohm resistors in series with the power amplifier output during the tuning cycle. This reduces the power in the output circuit so that it will not be damaged when the antenna is being tuned. This resistor also provides isolation between the power amplifier and antenna tuner during the tuning cycle.



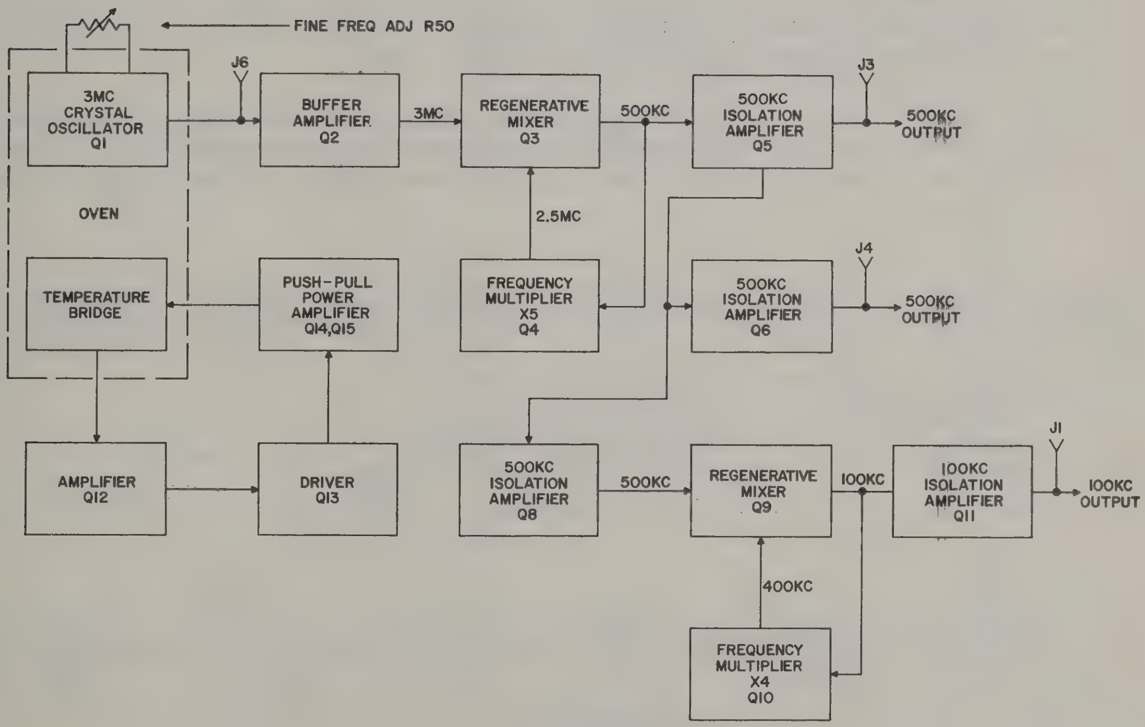
PEP Limiter, Simplified Schematic Diagram
Figure 16

Figure 16 is a simplified schematic diagram of the PEP limiting circuit of the power amplifier. This circuit limits the peak envelope power applied to the antenna coupler to a safe level. Resistor R38 is adjusted so that a sufficiently large positive r-f voltage swing will cause diodes CR8a and CR8b to conduct. Current will flow through resistor R1, developing a voltage that is applied to the base of alc amplifier A3Q1 in the i-f translator module. This action limits the r-f driving voltage that is applied to power amplifier tubes V1 and V2 to a safe level.

G. R-F Oscillator Module, A2.

Figure 1111 is a schematic diagram of the r-f oscillator module.

Refer to figure 17, a block diagram of the r-f oscillator module. A 3-mc signal is generated by the temperature-compensated crystal oscillator subassembly, A2A1. The 3-mc signal is applied to locked oscillator divider Q4. This locked oscillator divides the 3-mc frequency by 6 to produce a 500-kc output. This 500-kc output is applied to amplifier Q5 and emitter-follower amplifier Q7. The output of amplifier Q5 is fed to the megacycle frequency stabilizer module and to amplifier Q6. The output of Q6 is fed to the i-f translator module. Emitter-follower Q7 isolates locked oscillator Q8 from preceding circuit stages. The 500-kc signal from Q7 is applied to locked oscillator divider Q8. This locked oscillator divides the 500-kc signal by 5 to produce a 100-kc output. This output is amplified by 100-kc amplifier stage Q9 and fed to the frequency divider module.



R-F Oscillator Module, Block Diagram
Figure 17

The 3-mc crystal oscillator in this module is the basis of the entire 618T-( ) frequency scheme. Therefore, it is very important that the oscillator frequency be kept as constant as possible. To do this, the crystal is enclosed in a temperature-regulating oven which maintains the crystal temperature at 80 ±0.2 degrees C. The oven control circuit consists of a temperature-sensitive bridge and an audio amplifier composed of Q12 through Q15.

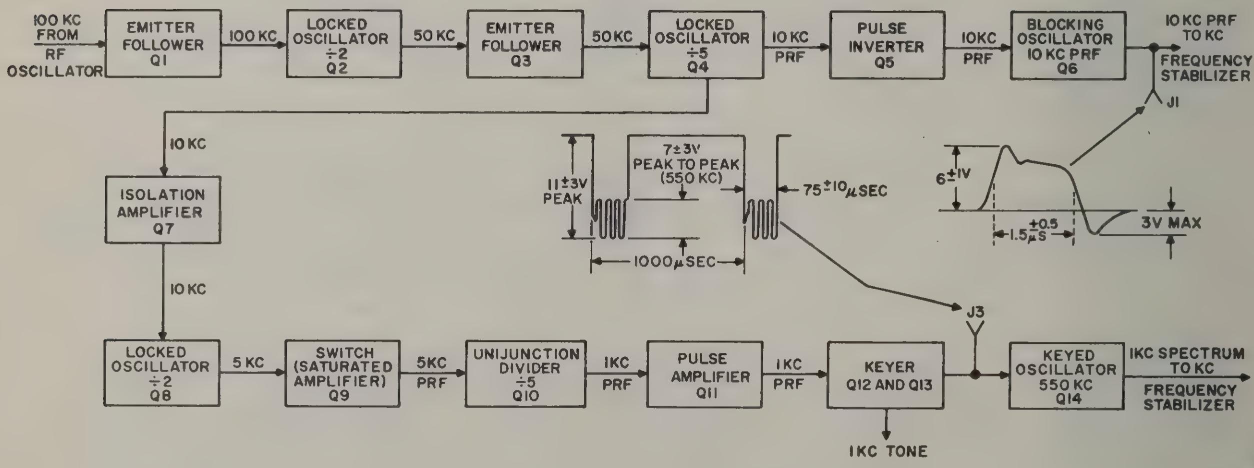
The bridge is composed of four resistance windings. The resistance values of two of the windings, made of a copper-nickel alloy, do not vary with temperature. These windings are on opposite legs of the bridge. The resistance values of the other two windings, which are made of pure copper, vary with temperature, the resistances being greater at a higher temperature. The resistances of the two temperature-variable windings are chosen so that when the temperature of the oven is at the preset value, the values of all four winding resistances are equal, and the bridge output is zero.

H. Frequency Divider Module, A1.

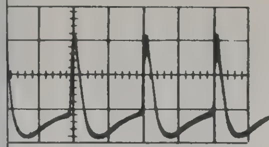
The frequency divider module transforms a 100-kc sine-wave input from the r-f oscillator module to a 10-kc pulse and a 1-kc spectrum which is centered at 550 kc. These outputs are used for frequency stabilization in the kilocycle stabilizer module. Figure 1112 is a schematic diagram of the frequency divider module.

Refer to figures 18 and 19. The 100-kc input from the r-f oscillator module is fed through an emitter-follower amplifier, Q1, to a locked oscillator, Q2. This locked oscillator divides the 100-kc signal by two to produce a 50-kc output. The 50-kc output is fed through another emitter-follower amplifier, Q3, to another locked oscillator, Q4. This locked oscillator divides the 50 kc by five to produce a 10-kc output. The slightly distorted 10-kc signal is differentiated by C10 and R14 to produce a 10-kc pulse. This pulse is inverted by Q5 and used to trigger a blocking oscillator, Q6. The 10-kc pulse output of the blocking oscillator is coupled through transformer T1 to the connector plug.

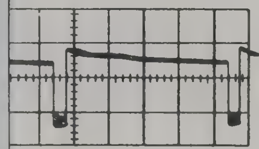
The 1-kc spectrum is produced as follows. Part of the 10-kc output of locked oscillator Q4 is fed through isolation amplifier Q7 to another locked oscillator, Q8. This locked oscillator divides the 10 kc by two to produce a 5-kc output. The 5-kc signal switches transistor Q9



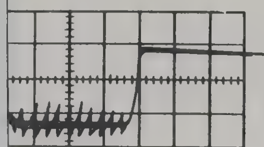
Frequency Divider Module, Block Diagram
Figure 18



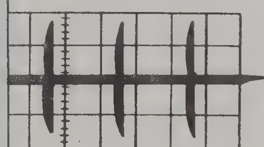
Cal tone output, TP6 (module extender) 500 usec/cm, 1.25 volts peak to peak across 5.6K ohms. (Remove AM/audio amplifier module for this check.)



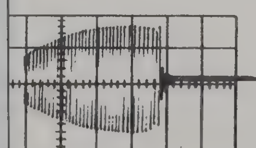
1-kc keyer, J3, 200 usec/cm, -11 volts peak



1-kc keyer, J3, expanded



1-kc spectrum, TP5, 500 usec/cm, 7 volts peak to peak



1-kc spectrum, TP5, expanded

Frequency Divider Waveforms
Figure 19

The 3-mc crystal oscillator in this module is the basis of the entire 618T-( ) frequency scheme. Therefore, it is very important that the oscillator frequency be kept as constant as possible. To do this, the crystal is enclosed in a temperature-regulating oven which maintains the crystal temperature at 80 ±0.2 degrees C. The oven control circuit consists of a temperature-sensitive bridge and an audio amplifier composed of Q12 through Q15.

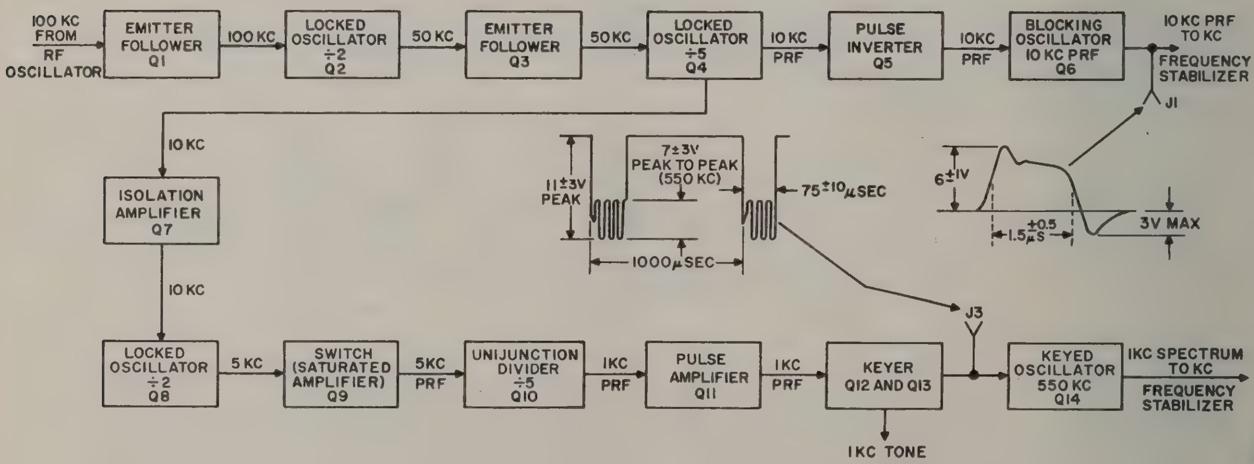
The bridge is composed of four resistance windings. The resistance values of two of the windings, made of a copper-nickel alloy, do not vary with temperature. These windings are on opposite legs of the bridge. The resistance values of the other two windings, which are made of pure copper, vary with temperature, the resistances being greater at a higher temperature. The resistances of the two temperature-variable windings are chosen so that when the temperature of the oven is at the preset value, the values of all four winding resistances are equal, and the bridge output is zero.

H. Frequency Divider Module, A1.

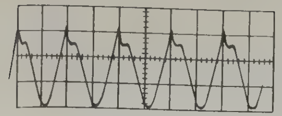
The frequency divider module transforms a 100-kc sine-wave input from the r-f oscillator module to a 10-kc pulse and a 1-kc spectrum which is centered at 550 kc. These outputs are used for frequency stabilization in the kilocycle stabilizer module. Figure 1112 is a schematic diagram of the frequency divider module.

Refer to figures 18 and 19. The 100-kc input from the r-f oscillator module is fed through an emitter-follower amplifier, Q1, to a locked oscillator, Q2. This locked oscillator divides the 100-kc signal by two to produce a 50-kc output. The 50-kc output is fed through another emitter-follower amplifier, Q3, to another locked oscillator, Q4. This locked oscillator divides the 50 kc by five to produce a 10-kc output. The slightly distorted 10-kc signal is differentiated by C10 and R14 to produce a 10-kc pulse. This pulse is inverted by Q5 and used to trigger a blocking oscillator, Q6. The 10-kc pulse output of the blocking oscillator is coupled through transformer T1 to the connector plug.

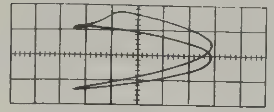
The 1-kc spectrum is produced as follows. Part of the 10-kc output of locked oscillator Q4 is fed through isolation amplifier Q7 to another locked oscillator, Q8. This locked oscillator divides the 10 kc by two to produce a 5-kc output. The 5-kc signal switches transistor Q9



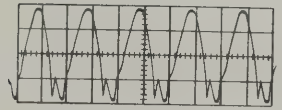
Frequency Divider Module, Block Diagram
Figure 18



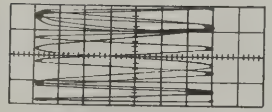
50-kc locked oscillator, TP1,
10 usec/cm,
1.5 volts peak to peak



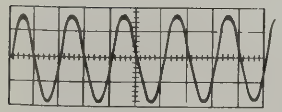
2-to-1 Lissajous figure, TP1



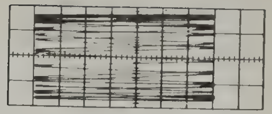
10-kc locked oscillator, TP2,
50 usec/cm,
2.3 volts peak to peak



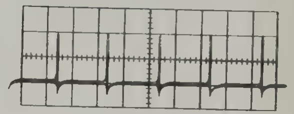
10-to-1 Lissajous figure, TP2



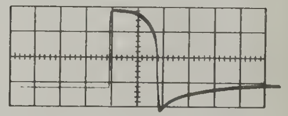
5-kc locked oscillator, TP3,
100 usec/cm,
4.5 volts peak to peak



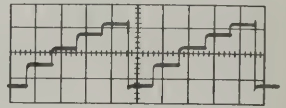
20-to-1 Lissajous figure, TP3



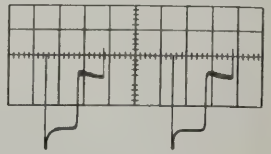
10-kc pulse output, J1,
50 usec/cm,
6 volts peak into
50-ohm load



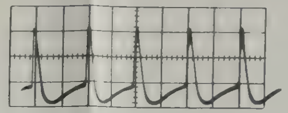
10-kc pulse output, J1,
1 usec/cm



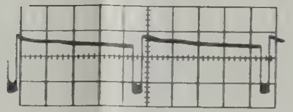
Unijunction divider, TP4,
200 usec/cm



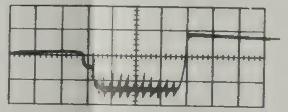
Unijunction divider, TP4,
5th step and firing point.
Firing point voltage
0.45 volt



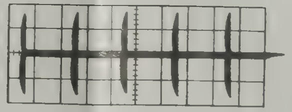
Cal tone output, TP6
(module extender)
500 usec/cm, 1.25
volts peak to peak
across 5.6K ohms.
(Remove AM/audio
amplifier module for
this check.)



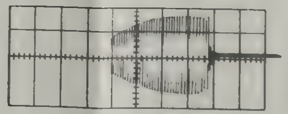
1-kc keyer, J3,
200 usec/cm,
-11 volts peak



1-kc keyer, J3,
expanded



1-kc spectrum, TP5,
500 usec/cm,
7 volts peak to peak



1-kc spectrum, TP5,
expanded

Frequency Divider Waveforms
Figure 19

to produce a positive square wave at the output of Q9. Refer to figure 1112. When Q9 is switched on, C22, C45, and C23 are charged through R28. When Q9 is switched off, C22 and C45 discharge through diode CR3 and R27. The charge on C23 is trapped by diode CR4. Thus, each square wave pulse charges C23 to a higher voltage. The value of the C22-C45 parallel combination determines how much voltage is added to C23 during each cycle. C23 is connected to the input of unijunction transistor Q10.

A unijunction transistor is a single-junction semiconductor device whose input is shorted to ground when it exceeds a certain value. When the transistor input voltage across C23 becomes high enough, C23 is discharged through Q10, causing a positive pulse to appear at the output of Q10. The value of C45 is selected so that on every fifth cycle, the voltage across C23 is sufficient to cause Q10 to conduct. Therefore, the 5-kc square-wave input to Q10 produces a 1-kc pulse output. This 1-kc pulse is amplified by Q11 and used to trigger a monostable multivibrator composed of Q12 and Q13. The multivibrator output keys a keyed oscillator, Q14, on and off at a 1-kc rate. The free-running frequency of the keyed oscillator is 550 kc. Therefore, the output of Q14 is a 1-kc spectrum centered around 550 kc. A series tuned circuit, L8-C33, produces the spectrum pulse. The 10-kc pulse and 1-kc spectrum outputs of the frequency divider module are fed to the kilocycle frequency stabilizer module.

The spectrums used in the frequency stabilization circuits in the 618T-( ) are a series of descrete frequencies, or spectrum points, spaced at equal intervals over a frequency range. These spectrums are produced by creating pulses of a certain frequency. A pulse with a repetition rate of exactly 1 kc, for example, is composed of a series of sine waves of various frequencies. A 1-kc pulse contains many sine-wave frequencies, each spaced exactly 1 kc from the others, at 2 kc, 3 kc, 4 kc, etc. The amplitudes of these 1-kc spectrum points decrease as the frequencies get farther away from the fundamental 1 kc.

Each spectrum point frequency has precisely the same frequency stability and phase relations as the original, fundamental 1-kc frequency. Therefore, spectrum points may be used as injection frequencies or reference frequencies in frequency stabilization circuits if they are generated by pulses that are derived from the crystal oscillator in the r-f oscillator module.

It was mentioned earlier that the amplitude of the 1-kc spectrum point frequencies decreases as the frequencies get farther away from the fundamental 1 kc. In some instances, it is desirable to use spectrum points that are so far from the fundamental that their amplitude is too small to be useful. Suppose, for example, that the 1-kc spectrum points around 550 kc are needed. It is possible to increase the amplitude of the spectrum frequencies around 550 kc in the following manner.

The fundamental 1-kc pulse is used to synchronize a monostable multivibrator at 1 kc. The multivibrator output is a 1-kc rectangular pulse. This pulse keys a free-running oscillator on and off at a 1-kc rate. The keyed oscillator is tuned to the frequency about which the spectrum points are to be used; in this case, it is tuned to 550 kc.

It is not necessary, however, for the free-running frequency of the keyed oscillator to be exactly 550 kc in order for a spectrum point to be at 550 kc. The free-running oscillator frequency does not appear in the spectrum. It merely determines the frequency about which the amplitude of the spectrum frequencies will be greatest. In the example, if the keyed oscillator were tuned to 550.2 kc, and keyed by an exact 1-kc pulse, the spectrum output would be a series of frequencies, one at exactly 550 kc and others extending on each side of 550 kc at exact 1-kc intervals. The amplitudes of the spectrum points decrease as they get farther from 550 kc.

It is important to remember that each spectrum point frequency is as stable and exact as the original 1-kc keying frequency, and that the free-running frequency of the keyed oscillator

only determines the frequency around which the amplitude of the spectrum points is greatest, so it does not have to be exact.

I. Kilocycle Frequency Stabilizer Module, A4.

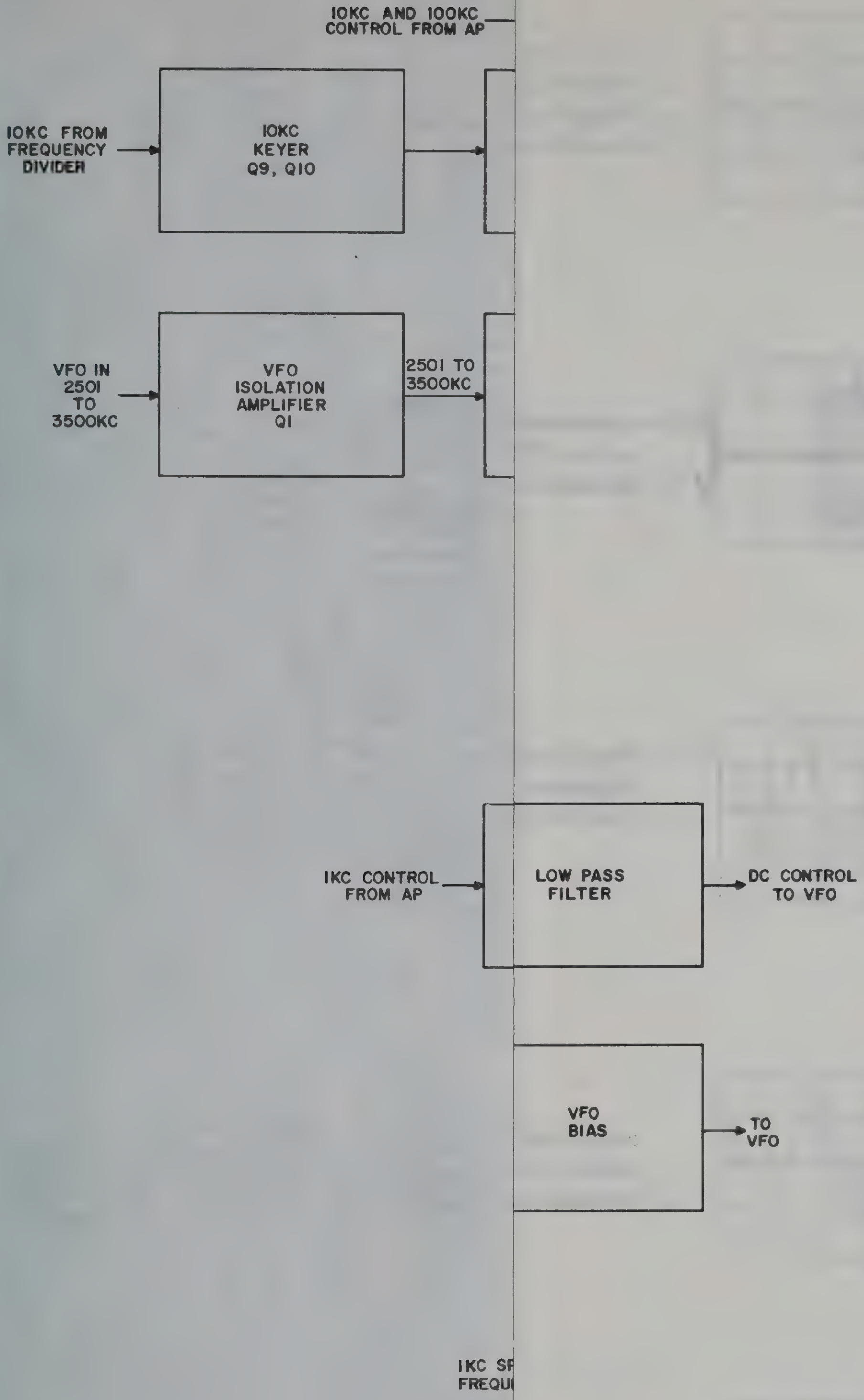
The kilocycle frequency stabilizer module stabilizes the frequency of the vfo submodule the r-f translator module. Figure 1113 is a schematic diagram of the kilocycle frequen stabilizer module.

Refer to figures 20 and 21. The vfo frequency is phase locked in 1-kc steps with the crystal-generated reference frequency from the r-f oscillator module by the action of the kilocycle stabilizer. A voltage-sensitive capacitor in the tuned circuit of the vfo tunes the vfo according to a d-c tuning voltage from the kilocycle stabilizer. The tuning voltage for this voltage-sensitive capacitor is a combination of an adjustable bias voltage from a bias supply in the kilocycle stabilizer module, and frequency- and phase-sensitive control voltages from frequency and phase discriminators in the module.

The inputs to the phase discriminator are two 250-kc signals. One is the vfo frequency that has been heterodyned to 250 kc. The other is the crystal r-f oscillator frequency that has been heterodyned to 250 kc. The phase discriminator output is a d-c error signal, proportional to the phase difference between the two 250-kc signals. This error signal "pulls" the vfo frequency, by tuning the voltage-sensitive capacitors in the vfo, until the two signals are phase locked. By phase locking the vfo to the r-f oscillator, the vfo frequency is as accurate as that of the r-f oscillator reference frequency.

The heterodyning of the vfo signal is as follows. The vfo output, which varies from 3500 to 2501 kc in 1000 1-kc steps, is amplified by Q1 and mixed in Q2 with a spectrum of frequencies, spaced 10 kc apart, which are centered 550 kc higher in frequency than the vfo. As the vfo is tuned from 3500 to 2501 kc, the center of the 10-kc spectrum moves from 4050 to 3050 kc. This 10-kc spectrum is derived from the 10-kc pulse from the frequency divider module. The 10-kc pulse synchronizes a monostable multivibrator, Q9 and Q10, which, in turn, keys a keyed oscillator, Q11, as to produce the spectrum. The free-running frequency of this keyed oscillator determines the frequency about which the 10-kc spectrum points are located, and is tuned to stay 550 kc higher than the vfo. The keyed oscillator is tuned by a d-c voltage applied to a voltage-sensitive capacitor, C52. The tuning voltage comes from a precision resistive divider located in the Autopositioner submodule.

The output of mixer Q2 is the difference between the vfo frequency and the 10-kc spectrum frequencies. Therefore, the mixer output contains frequencies spaced 10 kc apart and centered around 550 kc. The exact frequencies present depend on the vfo frequency being fed into the mixer, Q2. This series of frequencies is fed into a second mixer, Q3, where it is mixed with a signal from a free-running digit oscillator, Q12. The digit oscillator output is a single frequency that is varied by the 1-kc frequency selector knob on the control unit. The digit oscillator is tuned by a voltage-sensitive capacitor, C66, to 10 1-kc frequencies from 296 to 305 kc. The tuning voltage for the digit oscillator is derived from another precision resistive divider in the Autopositioner submodule. The free-running digit oscillator frequency is such that when it is mixed in Q3 with the series of frequencies spaced 10 kc apart and centered around 550 kc, it will produce another series of frequencies spaced 10 kc apart, but centered around 250 kc. One of these frequencies will be 250 kc plus or minus the vfo frequency error and the digit oscillator frequency error. The output of mixer Q3 is passed through a mechanical filter, FL1, which has a bandwidth of 8 kc centered at 250 kc. The mixer output frequency near 250 kc is passed, but all the other frequencies are filtered out, for the nearest frequencies are 10 kc away, and will not pass through the filter, whose bandwidth extends 4 kc on either side of 250 kc. The signal i-f frequency (250 kc plus or minus the vfo and digit oscillator errors) is then amplified by i-f amplifiers Q5 through Q8 and fed into the frequency discriminator.



ncy Stabilizer Module,
k Diagram
gure 20

only determines the frequency around which the amplitude of the spectrum points is greatest, so it does not have to be exact.

I. Kilocycle Frequency Stabilizer Module, A4.

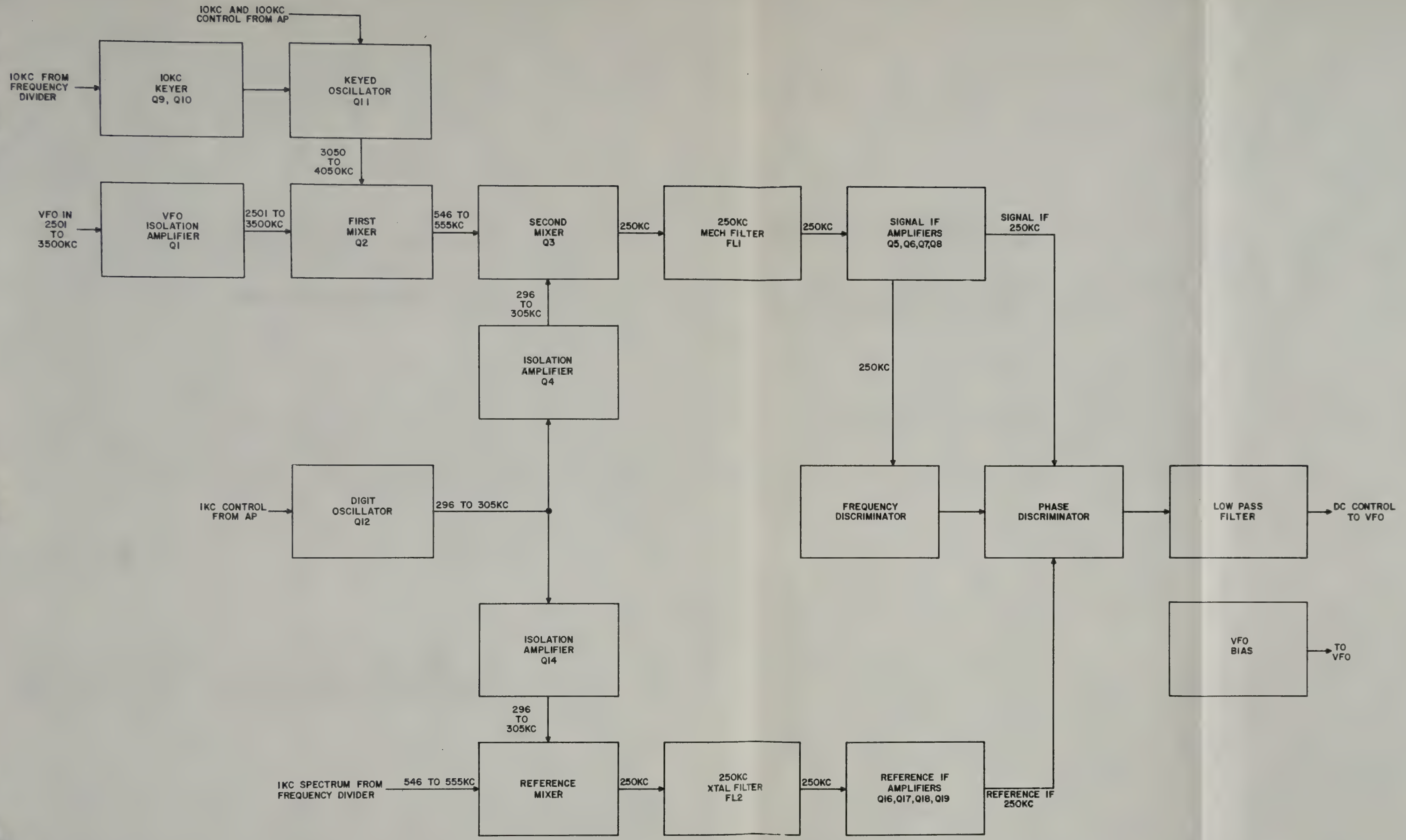
The kilocycle frequency stabilizer module stabilizes the frequency of the vfo submodule the r-f translator module. Figure 113 is a schematic diagram of the kilocycle frequen stabilizer module.

Refer to figures 20 and 21. The vfo frequency is phase locked in 1-kc steps with the crystal-generated reference frequency from the r-f oscillator module by the action of the kilocycle stabilizer. A voltage-sensitive capacitor in the tuned circuit of the vfo tunes the vfo according to a d-c tuning voltage from the kilocycle stabilizer. The tuning voltage for this voltage-sensitive capacitor is a combination of an adjustable bias voltage from a bias supply in the kilocycle stabilizer module, and frequency- and phase-sensitive control voltages from frequency and phase discriminators in the module.

The inputs to the phase discriminator are two 250-kc signals. One is the vfo frequency that has been heterodyned to 250 kc. The other is the crystal r-f oscillator frequency that has been heterodyned to 250 kc. The phase discriminator output is a d-c error signal, proportional to the phase difference between the two 250-kc signals. This error signal "pulls" the vfo frequency, by tuning the voltage-sensitive capacitors in the vfo, until the two signals are phase locked. By phase locking the vfo to the r-f oscillator, the vfo frequency is as accurate as that of the r-f oscillator reference frequency.

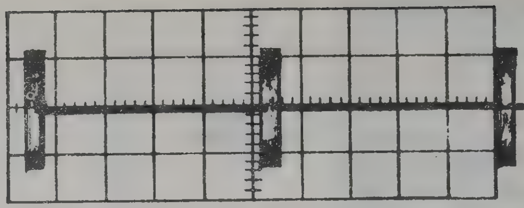
The heterodyning of the vfo signal is as follows. The vfo output, which varies from 3500 to 2501 kc in 1000 1-kc steps, is amplified by Q1 and mixed in Q2 with a spectrum of frequencies, spaced 10 kc apart, which are centered 550 kc higher in frequency than the vfo. As the vfo is tuned from 3500 to 2501 kc, the center of the 10-kc spectrum moves from 4050 to 3050 kc. This 10-kc spectrum is derived from the 10-kc pulse from the frequency divider module. The 10-kc pulse synchronizes a monostable multivibrator, Q9 and Q10, which, in turn, keys a keyed oscillator, Q11, as to produce the spectrum. The free-running frequency of this keyed oscillator determines the frequency about which the 10-kc spectrum points are located, and is tuned to stay 550 kc higher than the vfo. The keyed oscillator is tuned by a d-c voltage applied to a voltage-sensitive capacitor, C52. The tuning voltage comes from a precision resistive divider located in the Autopositioner submodule.

The output of mixer Q2 is the difference between the vfo frequency and the 10-kc spectrum frequencies. Therefore, the mixer output contains frequencies spaced 10 kc apart and centered around 550 kc. The exact frequencies present depend on the vfo frequency being fed into the mixer, Q2. This series of frequencies is fed into a second mixer, Q3, where it is mixed with a signal from a free-running digit oscillator, Q12. The digit oscillator output is a single frequency that is varied by the 1-kc frequency selector knob on the control unit. The digit oscillator is tuned by a voltage-sensitive capacitor, C66, to 10 1-kc frequencies from 296 to 305 kc. The tuning voltage for the digit oscillator is derived from another precision resistive divider in the Autopositioner submodule. The free-running digit oscillator frequency is such that when it is mixed in Q3 with the series of frequencies spaced 10 kc apart and centered around 550 kc, it will produce another series of frequencies spaced 10 kc apart, but centered around 250 kc. One of these frequencies will be 250 kc plus or minus the vfo frequency error and the digit oscillator frequency error. The output of mixer Q3 is passed through a mechanical filter, FL1, which has a bandwidth of 8 kc centered at 250 kc. The mixer output frequen near 250 kc is passed, but all the other frequencies are filtered out, for the nearest frequen are 10 kc away, and will not pass through the filter, whose bandwidth extends 4 kc on either side of 250 kc. The signal i-f frequency (250 kc plus or minus the vfo and digit oscillator errors) is then amplified by i-f amplifiers Q5 through Q8 and fed into the frequency discriminator.



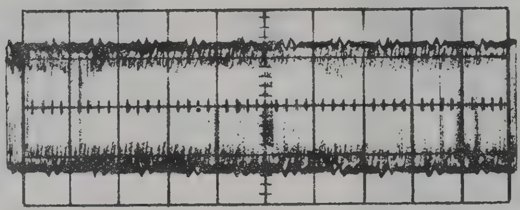
Kilocycle-Frequency Stabilizer Module,
Block Diagram
Figure 20

10-kc keyer output,
TP19,
5 volts/cm, 20 usec/cm



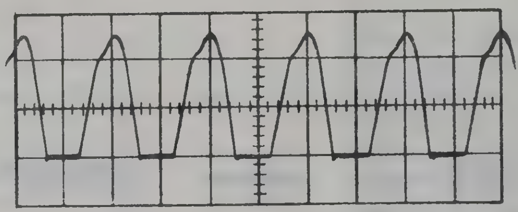
10-kc keyed oscillator
output, TP10,
2 volts/cm, 20 usec/cm

Vfo and 10-kc spectrum
input to first mixer TP1,
50 mv/cm, 100 usec/cm
(70K-5 vfo) 100 mv/cm,
100 usec/cm (70K-3 vfo)



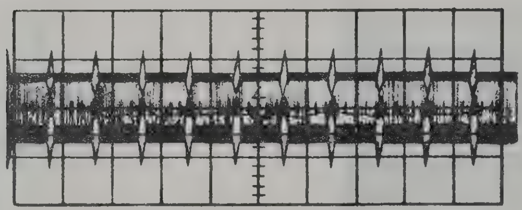
Digit oscillator and
10-kc spectrum input
to second mixer, TP2,
100 mv/cm, 100
usec/cm

Mechanical filter
output-signal i-f input,
J7, 50 mv/cm, 2 usec/cm



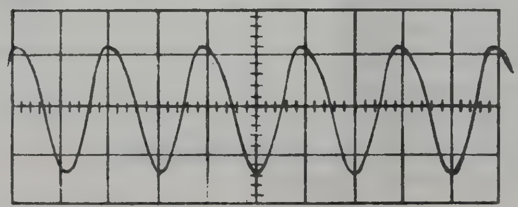
Signal i-f amplifier
interstage test point,
TP4,
1 volt/cm, 2 usec/cm

Signal i-f input to phase
discriminator, TP16,
5 volts/cm, 2 usec/cm



Digit oscillator and
1-kc spectrum input to
reference mixer, TP12,
100 mv/cm, 1 msec/cm

Reference i-f amplifier
interstage test point,
TP14,
50 mv/cm 2 usec/cm



Reference i-f amplifier
output, TP15,
1 volt/cm, 2 usec/cm

Kilocycle-Frequency Stabilizer Waveforms
Figure 21

The frequency discriminator output is a d-c voltage that tunes the voltage-sensitive capacitor in the vfo tuned circuit. Therefore, the frequency discriminator output "pulls" the vfo signal closer to 250 kc and within the "capturing" range of the phase disriminator.

To provide a reference signal for the phase discriminator, the digit oscillator output is mixed in Q15 with a series of frequencies spaced 1 kc apart and centered at 550 kc. This 1-kc spectrum comes from the frequency divider module. When this 1-kc spectrum, centered around 550 kc, is mixed with the digit oscillator output, the mixer output is a series of frequencies spaced 1 kc apart, centered around 250 kc. One of these frequencies will be 250 kc plus or minus the digit oscillator error. The output of mixer Q15 is passed through a crystal filter, FL2, which has a bandwidth of 0.8 kc centered at 250 kc. The mixer output frequency near 250 kc is passed, but all the other frequencies are filtered out, for the nearest frequencies are 1 kc away, and will not pass through the filter, whose bandwidth extends 400 cycles on either side of 250 kc. The reference i-f frequency (250 kc plus or minus the digit oscillator error) is then amplified by i-f amplifiers Q16 through Q19, and fed into the phase discriminator.

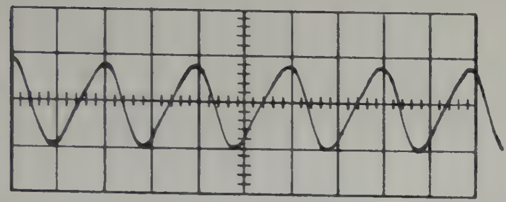
In order for the reference i-f to function properly, the digit oscillator must not vary more than ±200 cycles from its proper frequency. If the digit oscillator frequency exceeds these limits, the filter, FL2, will not pass the desired frequency to the reference i-f amplifiers. The error in the digit oscillator injection frequency is cancelled out in the phase discriminator because the oscillator output is mixed with both inputs to the discriminator. The phase discriminator control voltage overrides the frequency discriminator control voltage to phase lock the vfo frequency to the reference frequency, which is derived from the crystal r-f oscillator. Since all of the spectrum-point injection frequencies in the kilocycle stabilizer are derived from the crystal oscillator through the frequency divider module, they are all as stable as the crystal r-f oscillator itself. Therefore, the vfo is as stable as the r-f oscillator.

The vfo input from the vfo to the kilocycle stabilizer and the vfo d-c control voltage from the stabilizer to the vfo are both carried on the same line. The vfo r-f frequency is added to the d-c control voltage, so that there are both useful a-c and d-c components on the line. The two components are separated at the ends of the line. This method of carrying two separate information signals on the same line is called diplexing.

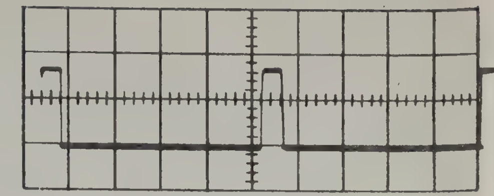
Because the frequency of the digit oscillator must be very accurate, the voltage that tunes the voltage-sensitive capacitor in the tuned circuit of the oscillator must be very exact. This tuning voltage (as well as the tuning voltages for the voltage-sensitive capacitors that tune the vfo and the keyed oscillator in the kilocycle stabilizer module) comes from a bridge circuit shown in figure 22. Part of the bridge is in the kilocycle stabilizer module, and part in the Autopositioner submodule.

The bridge circuit input is 130 volts d-c from the low-voltage power supply module. The bridge output is kept constant by the action of three series breakdown diodes, CR6, CR7, and CR8. The precision resistive divider in the Autopositioner that tunes the digit oscillator to its 10 steps is placed across the bridge output. The digit oscillator frequency may be adjusted by varying R59, which is in series with the resistive divider. The voltage that is tapped from the divider is fed to the voltage-sensitive capacitor in the digit oscillator tuned circuit.

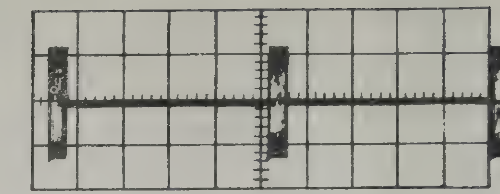
The vfo bias voltage and tuning voltage for the keyed oscillator in the kilocycle stabilizer are taken from precision resistive dividers which are connected across the breakdown-diode leg of the bridge. Currents in both of these dividers may be varied to produce the correct tuning voltage for the voltage-sensitive capacitors. A 40-ohm resistor, R58, placed in the bridge circuit opposite the diodes, equals the resistance of the diodes in the breakdown condition. This balances out any transients that may occur on the 130-volt d-c supply line.



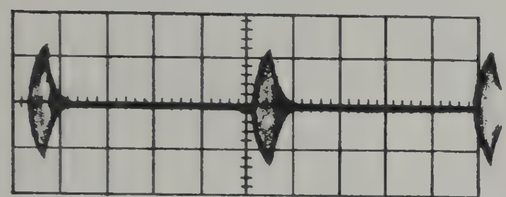
Vfo input, J1,
5 volts/cm, 2 usec/cm
(70K-5 vfo) 1 volt/cm,
2 usec/cm (70K-3 vfo)



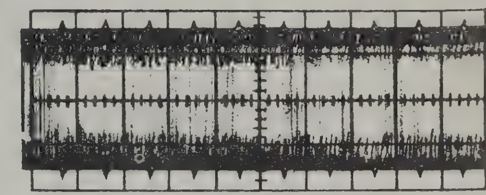
10-kc keyer output,
TP19,
5 volts/cm, 20 usec/cm



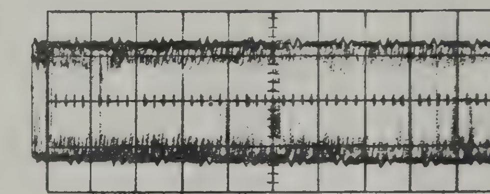
10-kc keyed oscillator
output, TP10,
2 volts/cm, 20 usec/cm



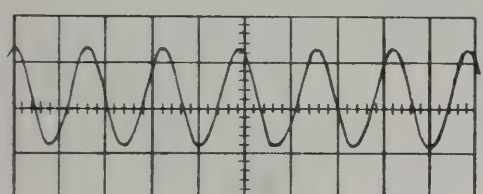
10-kc spectrum generator
output, TP8,
50 mv/cm, 20 usec/cm



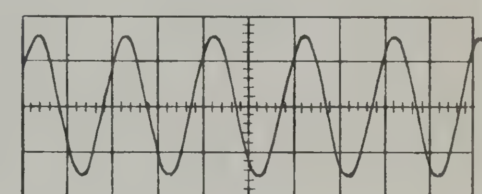
Vfo and 10-kc spectrum
input to first mixer TP1,
50 mv/cm, 100 usec/cm
(70K-5 vfo) 100 mv/cm,
100 usec/cm (70K-3 vfo)



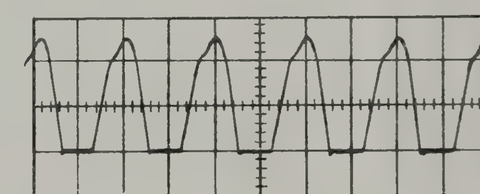
Digit oscillator and
10-kc spectrum input
to second mixer, TP2,
100 mv/cm, 100
usec/cm



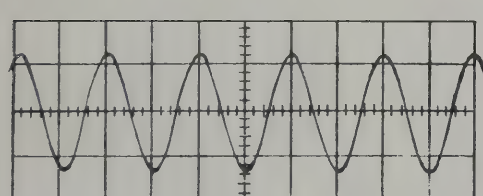
Digit oscillator isolation-
amplifier output, J5,
2 volts/cm, 2 usec/cm



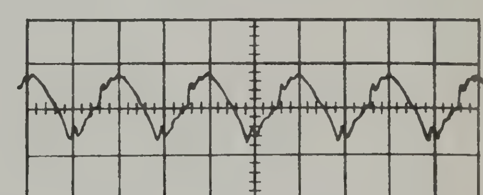
Mechanical filter
output-signal i-f input,
J7, 50 mv/cm, 2 usec/cm



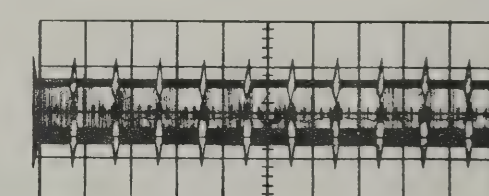
Signal i-f amplifier
interstage test point,
TP4,
1 volt/cm, 2 usec/cm



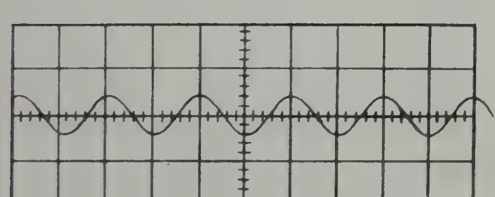
Signal i-f amplifier
output, TP5,
5 volts/cm, 2 usec/cm



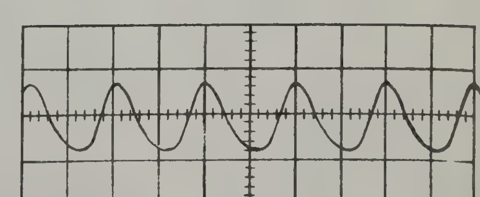
Signal i-f input to phase
discriminator, TP16,
5 volts/cm, 2 usec/cm



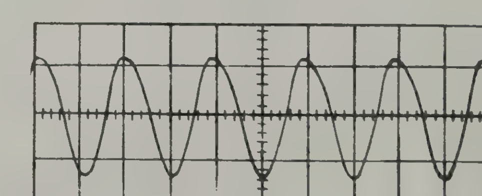
Digit oscillator and
1-kc spectrum input to
reference mixer, TP12,
100 mv/cm, 1 msec/cm



Crystal filter output-
reference i-f input, J8,
50 mv/cm, 2 usec/cm



Reference i-f amplifier
interstage test point,
TP14,
50 mv/cm 2 usec/cm



Reference i-f amplifier
output, TP15,
1 volt/cm, 2 usec/cm

Kilocycle-Frequency Stabilizer Waveforms
Figure 21

The frequency discriminator output is a d-c voltage that tunes the voltage-sensitive capacitor in the vfo tuned circuit. Therefore, the frequency discriminator output "pulls" the vfo signal closer to 250 kc and within the "capturing" range of the phase disriminator.

To provide a reference signal for the phase discriminator, the digit oscillator output is mixed in Q15 with a series of frequencies spaced 1 kc apart and centered at 550 kc. This 1-kc spectrum comes from the frequency divider module. When this 1-kc spectrum, centered around 550 kc, is mixed with the digit oscillator output, the mixer output is a series of frequencies spaced 1 kc apart, centered around 250 kc. One of these frequencies will be 250 kc plus or minus the digit oscillator error. The output of mixer Q15 is passed through a crystal filter, FL2, which has a bandwidth of 0.8 kc centered at 250 kc. The mixer output frequency near 250 kc is passed, but all the other frequencies are filtered out, for the nearest frequencies are 1 kc away, and will not pass through the filter, whose bandwidth extends 400 cycles on either side of 250 kc. The reference i-f frequency (250 kc plus or minus the digit oscillator error) is then amplified by i-f amplifiers Q16 through Q19, and fed into the phase discriminator.

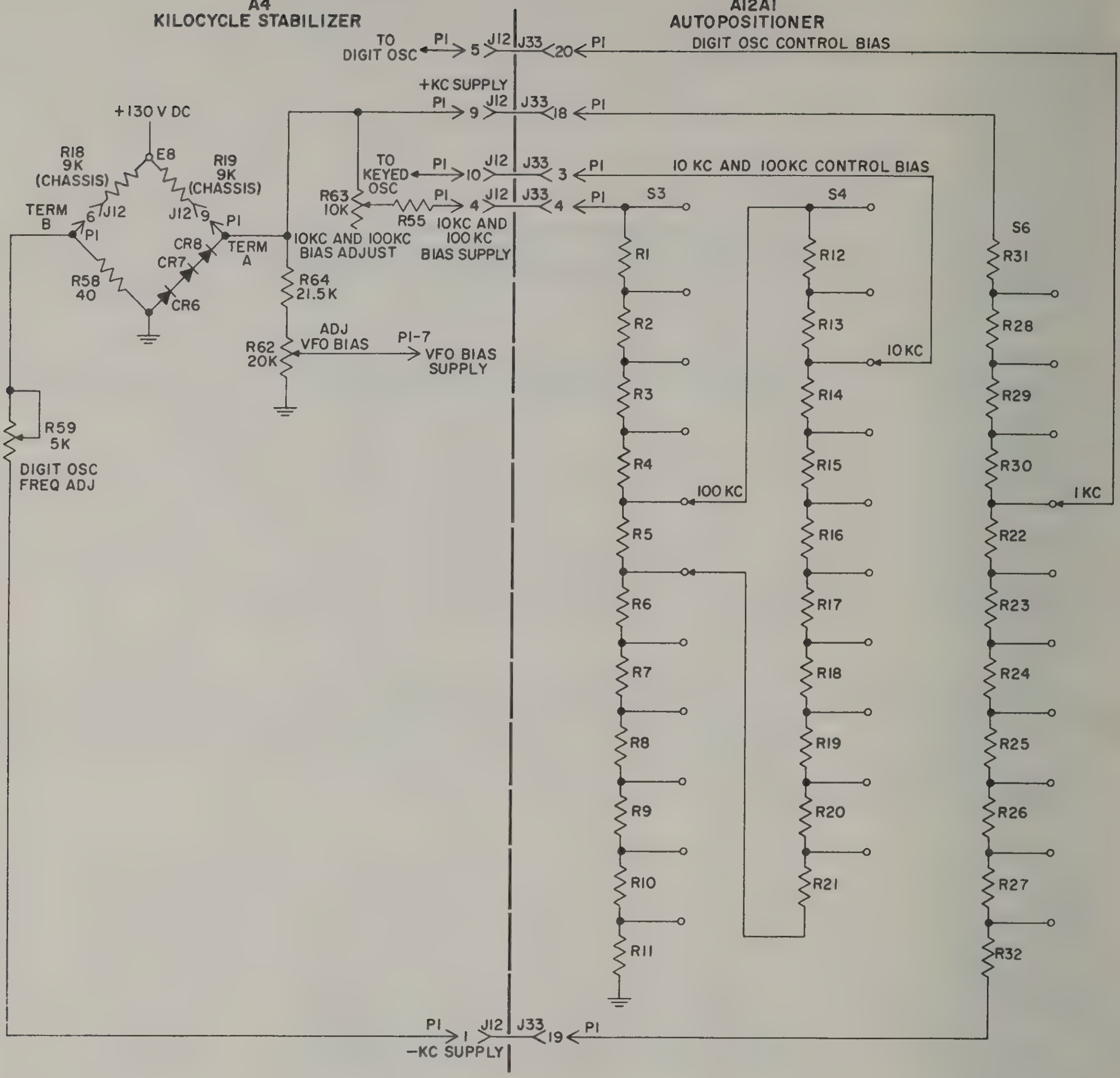
In order for the reference i-f to function properly, the digit oscillator must not vary more than ±200 cycles from its proper frequency. If the digit oscillator frequency exceeds these limits, the filter, FL2, will not pass the desired frequency to the reference i-f amplifiers. The error in the digit oscillator injection frequency is cancelled out in the phase discriminator because the oscillator output is mixed with both inputs to the discriminator. The phase discriminator control voltage overrides the frequency discriminator control voltage to phase lock the vfo frequency to the reference frequency, which is derived from the crystal r-f oscillator. Since all of the spectrum-point injection frequencies in the kilocycle stabilizer are derived from the crystal oscillator through the frequency divider module, they are all as stable as the crystal r-f oscillator itself. Therefore, the vfo is as stable as the r-f oscillator.

The vfo input from the vfo to the kilocycle stabilizer and the vfo d-c control voltage from the stabilizer to the vfo are both carried on the same line. The vfo r-f frequency is added to the d-c control voltage, so that there are both useful a-c and d-c components on the line. The two components are separated at the ends of the line. This method of carrying two separate information signals on the same line is called diplexing.

Because the frequency of the digit oscillator must be very accurate, the voltage that tunes the voltage-sensitive capacitor in the tuned circuit of the oscillator must be very exact. This tuning voltage (as well as the tuning voltages for the voltage-sensitive capacitors that tune the vfo and the keyed oscillator in the kilocycle stabilizer module) comes from a bridge circuit shown in figure 22. Part of the bridge is in the kilocycle stabilizer module, and part in the Autopositioner submodule.

The bridge circuit input is 130 volts d-c from the low-voltage power supply module. The bridge output is kept constant by the action of three series breakdown diodes, CR6, CR7, and CR8. The precision resistive divider in the Autopositioner that tunes the digit oscillator to its 10 steps is placed across the bridge output. The digit oscillator frequency may be adjusted by varying R59, which is in series with the resistive divider. The voltage that is tapped from the divider is fed to the voltage-sensitive capacitor in the digit oscillator tuned circuit.

The vfo bias voltage and tuning voltage for the keyed oscillator in the kilocycle stabilizer are taken from precision resistive dividers which are connected across the breakdown-diode leg of the bridge. Currents in both of these dividers may be varied to produce the correct tuning voltage for the voltage-sensitive capacitors. A 40-ohm resistor, R58, placed in the bridge circuit opposite the diodes, equals the resistance of the diodes in the breakdown condition. This balances out any transients that may occur on the 130-volt d-c supply line.



Voltage-Stabilizing Bridge Circuit, Simplified Schematic Diagram
Figure 22

J. Megacycle-Frequency Stabilizer Module, A10.

The megacycle-frequency stabilizer module stabilizes the frequencies of the 17.5-mc and h-f oscillators in the r-f translator module. Figure 1114 is a schematic diagram of the megacycle-frequency stabilizer module.

The following discussion describes the action that stabilizes the 17.5-mc oscillator. Its theory applies equally, however, to each of the 16 h-f oscillator frequencies.

Refer to figure 23. The megacycle-frequency stabilizer module is part of a feedback loop between the oscillator r-f output and the d-c tuning voltage input to the voltage-variable capacitor in the oscillator tuned circuit. This module is continually comparing the oscillator output frequency with a reference frequency and sending out a d-c tuning voltage that tunes the oscillator until it is phase-locked with the reference. If the oscillator tends to drift out of phase lock with the reference, the megacycle-frequency stabilizer module will sense this change and correct the oscillator tuning voltage to keep the oscillator phase locked with the reference at all times.

The term phase locked is used because it is possible for two frequencies to be exactly the same and still not be in phase, as shown in the upper part of figure 24. The two frequencies, A and B, are the same, but differ by the phase angle Ø. In the figure, A leads B by approximately 90 degrees. The middle part of figure 24 is a rotating-vector, or phasor, representation of the frequencies shown in the upper part. The phasors rotate counterclockwise at the same frequency, A leading B by approximately 90 degrees.

The 17.5-mc oscillator output frequency is fed to the input of the megacycle-frequency stabilizer module. In this module it passes through two amplifier stages to the input of a mixer. The other mixer input is a 500-kc reference pulse. The spectrum of this pulse is a series of reference frequencies, equally spaced at 500-kc intervals from 500 kc to approximately 25 mc. Each of these spectrum frequencies is a harmonic of the 500-kc reference pulse, so each is as accurate and stable as the reference.

The mixer output is tuned to 1 mc. When the 17.5-mc oscillator is phase locked with the reference spectrum frequencies, the mixer output will be a 1-mc signal that is a combination of three separate 1-mc components. These three 1-mc components are (1) the 1-mc component of the reference spectrum, (2) the mixer product that is the difference between the 17.5-mc oscillator frequency and the 18.5-mc reference spectrum component 1 mc above it, and (3) the mixer product that is the difference between the 17.5-mc oscillator frequency and the 16.5-mc reference spectrum component 1 mc below it.

Refer to the lower part of figure 24. This figure is a phasor representation of the three 1-mc mixer-output components. The 1-mc reference frequency is represented by the vertical phasor that is rotating counterclockwise at a 1-mc rate. The two mixer products are represented by the two phasors approximately 90 degrees out of phase with the reference. These two signal phasors always lead and lag the reference by equal angles for the reason shown below.

If the oscillator frequency, for example, leads the reference frequency by phase angle Ø, one mixer product will be

$$18.5 - (17.5 + \emptyset) = 1.0 - \emptyset,$$

and the other mixer product will be

$$(17.5 + \emptyset) - 16.5 = 1.0 + \emptyset.$$

Thus, the two phasors are at equal angles to the reference, one leading and one lagging.

If the oscillator is phase locked with the reference, the three phasors are all rotating at exactly the same frequency, and the sum of these three 1-mc components will be a single, 1-mc frequency represented by a vertical phasor that is in phase with the reference phasor. This 1-mc signal is amplified by a 1-mc i-f amplifier and then rectified by a diode detector. The detector output is a d-c voltage that is fed back to a voltage-variable capacitor in the oscillator tuned circuit to control the oscillator frequency. Thus, the feedback loop is completed.

The phase-locked state of the oscillator is an equilibrium point for the feedback circuit. If either the tuning voltage or oscillator frequency changes, the other will change to compensate for the original change, keeping the oscillator and reference frequencies phase locked at all times.

If, for example, the oscillator frequency drifts with respect to the reference, the phase angle between the signal and reference frequencies will change. As this angle changes, the signal phasors will shift position and cause the length of the sum phasor to change. Since the d-c tuning voltage is obtained by rectifying the a-c voltage represented by the sum phasor, the tuning voltage is proportional to the length of the sum phasor and will also change. This change in tuning voltage will retune the oscillator to correct the frequency drift and keep the oscillator and reference phase locked.

The length of the sum phasor, however, is limited to a value determined by the lengths of the three component phasors. If the frequency drift is great enough to cause the signal phasors to drift into phase with the reference, this limiting value will be reached, the tuning voltage can no longer change, and the oscillator will drift out of lock with the reference.

To eliminate this problem, the tuning-voltage output of the megacycle-frequency stabilizer is applied across a capacitor connected to the input of a unijunction transistor. When the oscillator frequency drifts so that the angle between the reference and signal phasors places the signal phasors at the V_{max} position, the sum vector will become long enough to produce a tuning voltage (V_{max}) that equals the unijunction conduction voltage. When this happens, the capacitor will be shorted, and the tuning voltage will be quickly reduced to a low value. This tuning-voltage change will abruptly retune the oscillator and cause the signal phasors to be repositioned to the V_{min} position. As the capacitor begins to rechange, the tuning voltage will increase, and the oscillator frequency will sweep across a frequency range limited by the tuning-voltage range allowed by the unijunction stage. As the oscillator frequency changes, it will eventually reach the equilibrium point at which the tuning voltage value will cause the reference and signal to be phase locked. When this point is reached, the sum phasor will again be the sum of the three 1-mc phasors and will cause a d-c tuning voltage that phase locks the oscillator.

If the feedback loop is opened so that the d-c tuning-voltage output of megacycle-frequency stabilizer no longer controls the oscillator frequency, the oscillator frequency will continue to drift with respect to the reference, and the unijunction stage will recycle continuously. The movement of the signal phasors in this recycle condition will be up and down between the V_{max} and V_{min} positions. If the loop is closed, the signal phasors will stop when they reached the locked position, for this is the equilibrium point of the feedback circuit.

Note that when the oscillator is locked, the signal phasors should be slightly less than 90 degrees out of phase with the reference. This will cause the sum phasor to be slightly greater than the reference phasor. The position of the signal phasors in the locked position may be varied by adjusting the variable inductor in the oscillator tuned circuit. Doing this will cause the value of capacitance needed to lock the oscillator to change, and, therefore, will require the d-c tuning voltage to change. When the inductance is changed, the signal phasors will

reposition to produce the required tuning voltage. The oscillator will remain locked as long as the signal phasors are anywhere in the range between the V_{max} and V_{min} positions.

The length of the reference phasor may be adjusted by disconnecting the oscillator input to the megaycle-frequency stabilizer. This will eliminate the signal phasors, leaving the sum phasor equal to the reference phasor. The amplitude of the 500-kc reference spectrum pulse then is adjusted to give a reference phasor length that will produce a tuning voltage of approximately 6.5 volts d-c.

The 500-kc reference pulse is produced as follows. The 500-kc reference sine-wave input from the r-f oscillator module is shaped by a squaring amplifier into a rectangular pulse. This rectangular pulse is applied to a pulse generator that sharpens the pulse leading edge. The output of the pulse generator is further differentiated by an RL network to produce the 500-kc pulse that is fed to the mixer input.

K. Low-Voltage Power Supply Module, A5.

The low-voltage power supply module (1) contains a transient blanker circuit that protects transistors in the 618T-( ) from transient line-voltage surges, (2) contains an 18-volt voltage regulator that provides stable transistor supply voltages, and (3) contains a rectifier-filter circuit that derives 130 volts d-c from a 115-volt, 400-cycle input. Figure 1115 is a schematic diagram of the low voltage power supply module.

(1) Transient Blanker Circuit.

When large electric motors used in aircraft are switched off, the load on the aircraft main electrical power supply is changed, causing transient voltage peaks on the 27.5-volt d-c line to the 618T-( ). These voltage peaks reach approximately +80 volts, and return to normal line voltage in approximately 0.5 second. Since transistors used in the 618T-( ) will not stand such high voltages, a transient blanker circuit is used to protect the transistors. The blanker circuit drops the 27.5 volt d-c line voltage to approximately zero volt for the duration of the transient. The waveforms in figure 25 illustrate the action of the transient blanker circuit.

Refer to figure 26. The switching action of switching transistor Q2 is accomplished with a control transistor, Q1, a biasing control diode, CR1, and biasing resistors. R2 through R6 form a bias network which performs two functions. First, it allows Q2 to be biased to saturation when the line voltage is normal. This connects the output load to the 27.5 volt d-c line. Second, it provides a variable bias voltage at the tap of R5. This bias voltage controls the point at which the transient blanker circuit operates. The level at which the circuit operates is determined by the setting of potentiometer R5.

The operation of the transient blanker circuit is as follows. When the line voltage is less than +32 volts, bias current flows through the emitter-base junction of Q2 and through resistors R2 through R6. Q2 is saturated and places the collector at emitter potential, which is the 27.5-volt d-c line voltage. The bias voltage at the tap of R5 is too small to cause the breakdown diode, CR1, to conduct. Since CR1 does not conduct, Q1 is off-biased.

When a transient occurs on the 27.5-volt line, the emitter current in Q2 will increase. The voltage at the tap of R5 will increase proportionately. R5 is adjusted so that when the input (line) voltage reaches +32 volts d-c, the voltage at the tap on R5 will be sufficient to cause CR1 to break down and allow emitter current to flow in Q1. When this happens, Q1 will be biased to saturation. This will shunt the emitter-base circuit of Q2, removing the load from the 27.5-volt line. The blanking action will continue as long as the transient voltage is above +32 volts.

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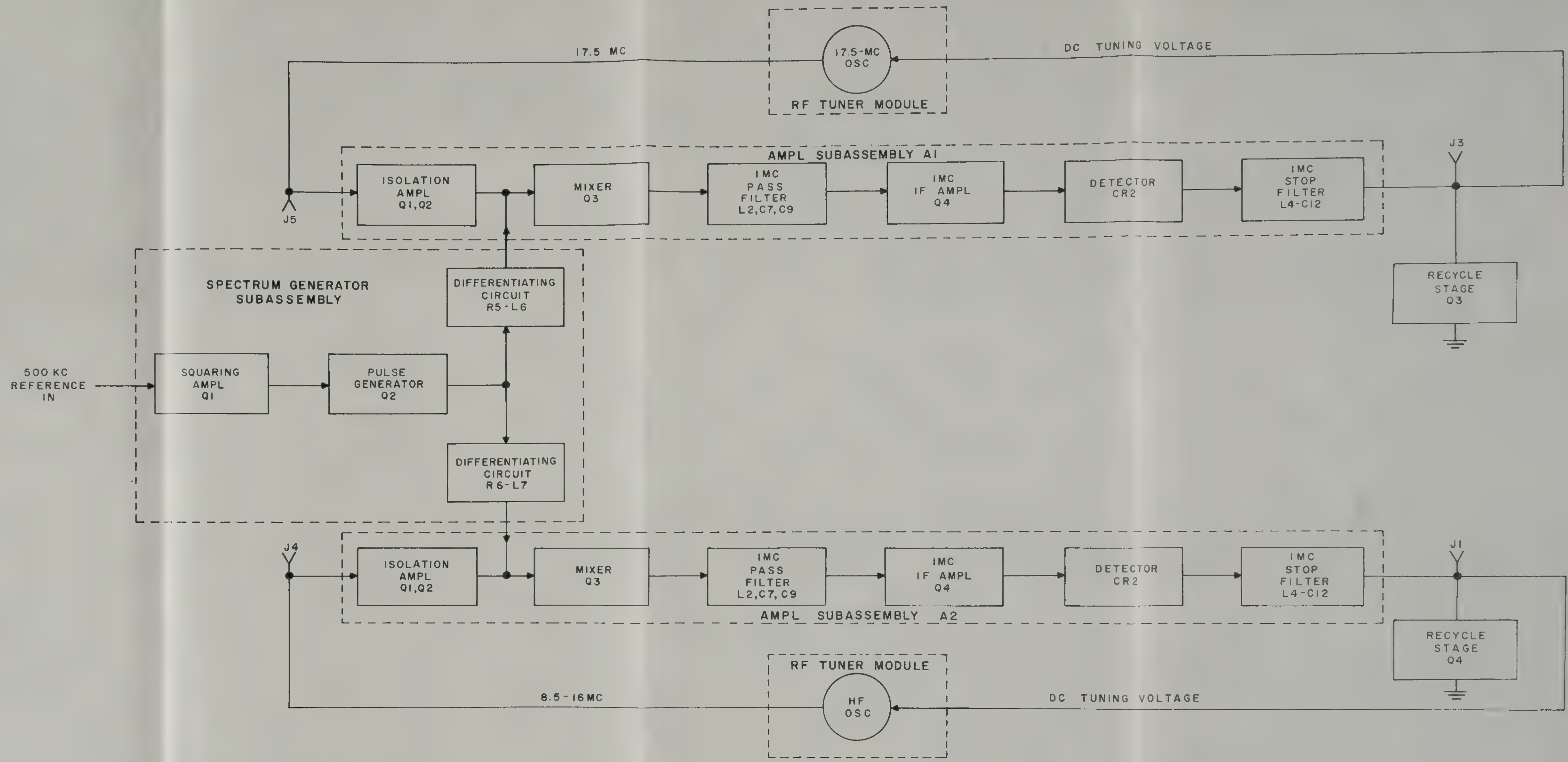
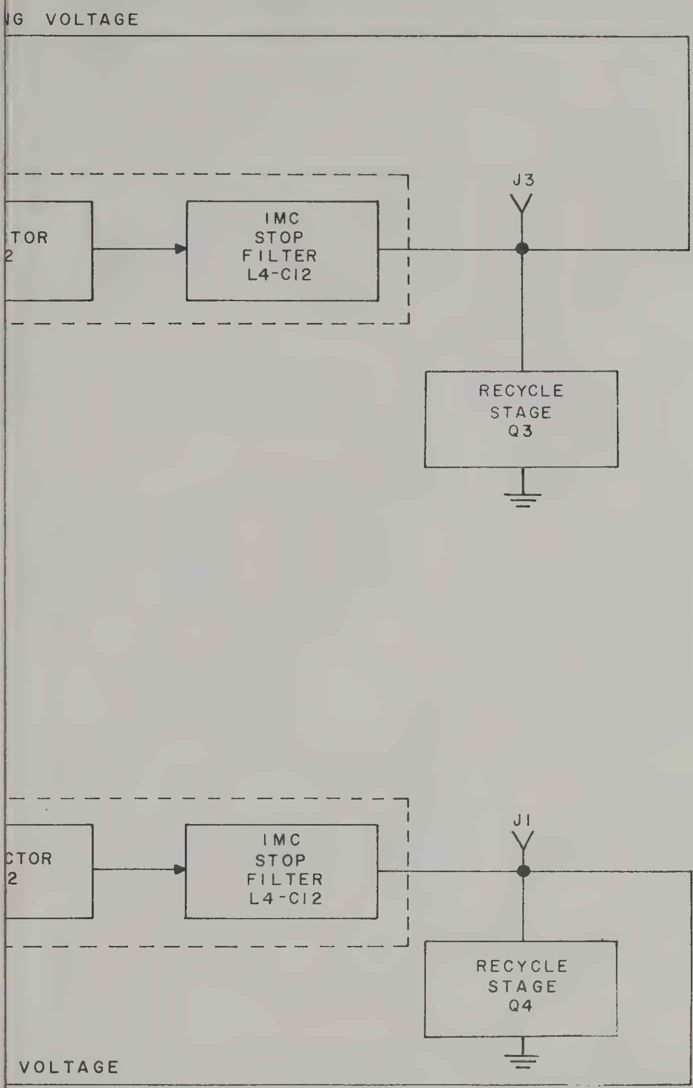


Megacycle-Frequency Stabilizer Module,
Block Diagram
Figure 23



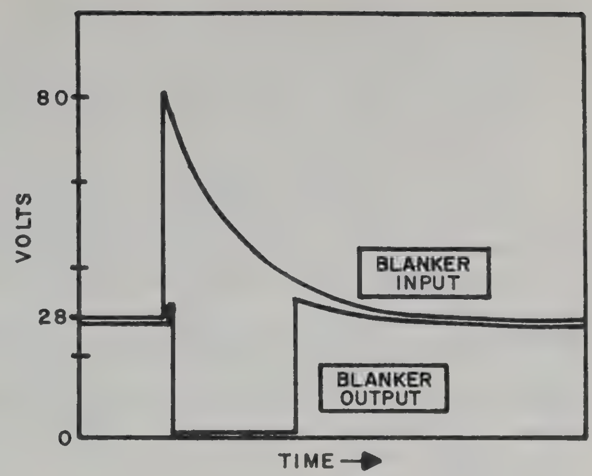
Megacycle-Frequency Stabilizer Module,
Block Diagram
Figure 23

When the transient voltage decreases to below +32 volts, CR1 will stop conducting and Q1 will be biased off. Q2 will no longer be shunted by Q1 and emitter current will flow again in Q2. Collector current flows through Q2 to the load, and normal operation is restored.

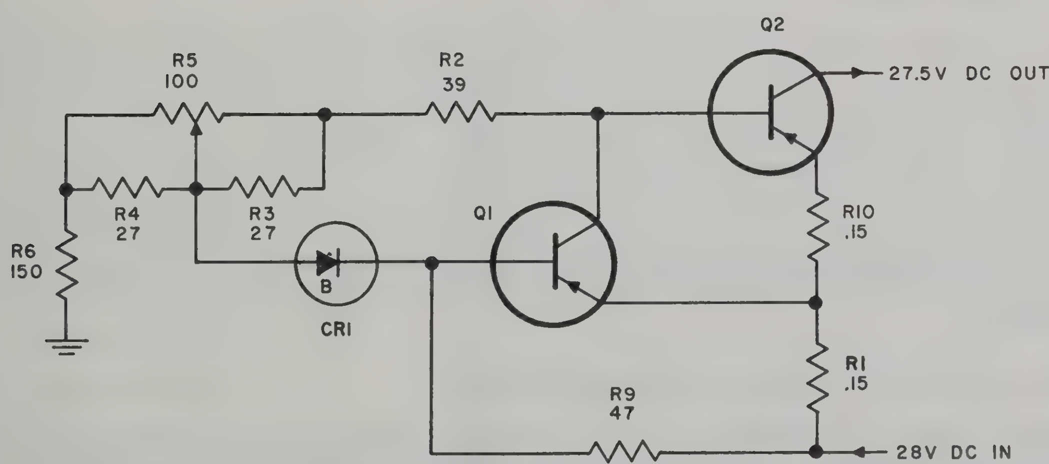
(2) Voltage Regulator Circuit.

The 18-volt voltage regulator is composed of two cascaded amplifiers whose input is an error signal from the regulator output, and a control transistor whose voltage is very closely regulated by the amplifiers.

Refer to figure 1115. The emitter voltage of Q4 is kept constant by a breakdown diode, CR2. The base voltage of Q4 is picked off a resistive divider in the output circuit, making it directly proportional to the output voltage. Thus, the emitter-base input of amplifier Q4 is proportional to the regulator output voltage. Amplifiers Q4 and Q3 amplify the output error signal. The output of Q3 controls the input of Q5, and, therefore, the emitter-collector voltage of Q5. R15 in the resistive divider is adjusted to give 18 volts d-c at the regulator output.



Transient Blanker Waveforms
Figure 25



Transient Blanker Circuit, Schematic Diagram
Figure 26

If the regulator output is accidentally shorted, the regulator will be disabled, for the regulating action is controlled by the output voltage. In order to start the circuit after its output has been shorted, it is necessary to produce a positive voltage at the regulator output. This is done by interrupting the 25-volt input to the regulator, by switching the 618T-( ) off, then on again. When the input voltage is interrupted, C4, which has been charged to the input voltage, will discharge through R18. When the input voltage is reapplied, current will flow through the emitter-base junction of Q3, CR4, and R12 to charge C4. This transient current will cause collector current to flow in Q3 and through the emitter-base junction of Q5 and the resistive divider. The current through the resistive divider produces a positive voltage at the tap of R15 which starts the regulating action.

L. Power Supply 516H-1 and Single-Phase High-Voltage Power Supply Module, A13.

Power Supply 516H-1 is an external power supply that is used, in conjunction with a single-phase high-voltage power supply module, to provide operating voltages for Airborne SSB Transceiver 618T-1. The 516H-1 mounts directly in the shockmount tray used by Power Supply 416W, the power supply for the 618S, and is used primarily in 618S retrofit installations. Figure 116 is a schematic diagram of Power Supply 516H-1.

The 516H-1 is completely transistorized, and uses a saturable-core oscillator to convert 27.5 volts d-c to 1500-cycle a-c. The saturable-core oscillators, Q1 and Q2, used in the inverter circuit, are fast-acting switches whose switching action depends on the saturation of the core of transformer T1 in the oscillator circuit. When the oscillator is first energized, unbalance in the two halves of the oscillator circuit causes saturation current to flow in one transistor and the other transistor to be cut off. This current increases until the core of transformer T1 becomes saturated. When this occurs, voltage is no longer induced in the windings of T1 and the saturation current is cut off. When the magnetic field in the transformer windings starts to collapse, voltages are induced in the windings which cause the transistor that was previously cut off to be saturated, and vice versa. This action produces a square-wave output at the transformer output. This square wave switches transistors Q3 through Q8, in a push-pull power circuit, to provide a 400-volt, 1500-cycle square-wave output from the power supply. The output of Power Supply 516H-1 is fed to the single-phase high-voltage power supply module.

The single-phase high-voltage power supply module, which is contained in the 618T-1( ) case, steps up the 400-volt, 1500-cycle input to 1500 volts, and rectifies it to provide the 1500-volt d-c plate voltage for the power amplifier. Figure 117 is a schematic diagram of the single-phase high-voltage power supply module. This module also supplies tgc control voltage, vacuum-tube filament voltage, and a 260-volt d-c plate voltage for tubes in the r-f translator module. Early modules also provide 400-volts for power amplifier screen voltage. In later models of the 618T-( ), however, this screen voltage is derived from the 1500-volt plate voltage input to the power amplifier module. The single-phase high voltage power supply module also contains an overload relay which is automatically reset when the keyline ground is removed.

M. Three-Phase High-Voltage Power Supply Module, A7.

The three-phase high-voltage power supply module is a single unit that plugs into the 618T-2 chassis and derives its operating voltages from a 115-volt (line to neutral), 400-cycle, three-phase primary power source. This module is used only in Airborne SSB Transceiver 618T-2. Figure 118 is a schematic diagram of the three-phase high-voltage power supply module. The plate contactor relay, K1, is energized 30 seconds after the 618T-( ) is turned on at the control unit. This delay is accomplished by high-voltage time delay relay K7. See figure 118. Resistors R1, R2, and R3 are in series with the input transformer primary winding to limit the transient current which flows when relay K1 is energized. After the

initial transient surge, step-start relay K2 is energized and the series resistors are shorted out of the circuit. The capacitors across the diodes in the rectifier circuit protect the diodes from transient supply voltage surges. The outputs of this module are the same as those of the single-phase high-voltage power supply module used in the 618T-1.

N. 27.5-Volt D-C High-Voltage Power Supply Module, A8.

The 27.5-volt d-c high-voltage power supply module is a single unit that plugs into the 618T-3 chassis and derives its operating voltages from a 27.5-volt d-c primary power source. This module is used only in Airborne SSB Transceiver 618T-3. Figure 1119 is a schematic diagram of the 27.5-volt d-c high-voltage power supply module. The action of this module is the same as the action of Power Supply 516H-1 and the single-phase high-voltage power supply module combination. The outputs of this module are the same as those of the single-phase and three-phase high-voltage power supply modules used in the 618T-1 and 618T-2.

O. Chassis.

(1) General.

The 618T-( ) chassis contains all the wiring that interconnects the modules used in the 618T-( ). The chassis also contains a relay compartment, located under the front panel, that houses many of the control-circuit relays. Figure 1120 is a wiring diagram of the 618T-( ) chassis.

(2) Power Distribution Circuits.

Figure 27 is a simplified schematic diagram of the power distribution circuits in the 618T-( ). These circuits are activated when the mode selector switch on the control unit is switched from OFF to any other position. A 400-cycle interlock relay in this circuit, K9, is connected so that the 618T-( ) operates only when there are both 115-volt, 400-cycle and 27.5-volt d-c inputs from the power supplies.

(3) Keying Circuits.

Figure 28 is a simplified schematic diagram of the keying circuits in the 618T-( ). These circuits are activated when the transmitter is keyed. The CW keying circuits are included in this diagram.

(4) Sidetone Circuits.

Figure 29 is a simplified schematic diagram of the sidetone circuits in the 618T-( ). The sidetone is taken from the last audio amplifier stage, A9Q2, to provide audio monitoring in the transmit mode. The audio signal from the audio amplifier is fed through a keying relay, K2, the sidetone level adjust network, and the sidetone relay, K6, to the audio output.

A combination of two voltages is necessary to energize the sidetone relay. One voltage is derived from the r-f output of the power amplifier. This r-f output is rectified by

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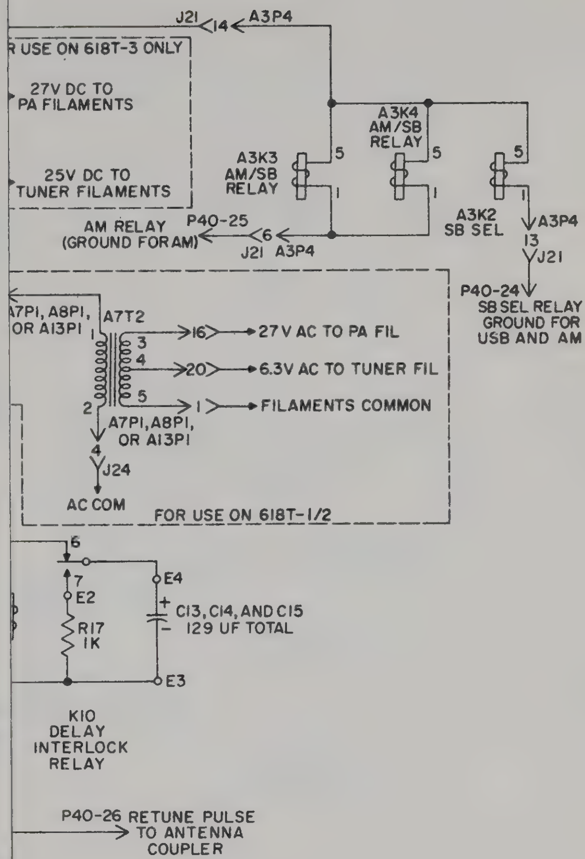

Power Distribution Circuits,
Simplified Schematic Diagram
Figure 27

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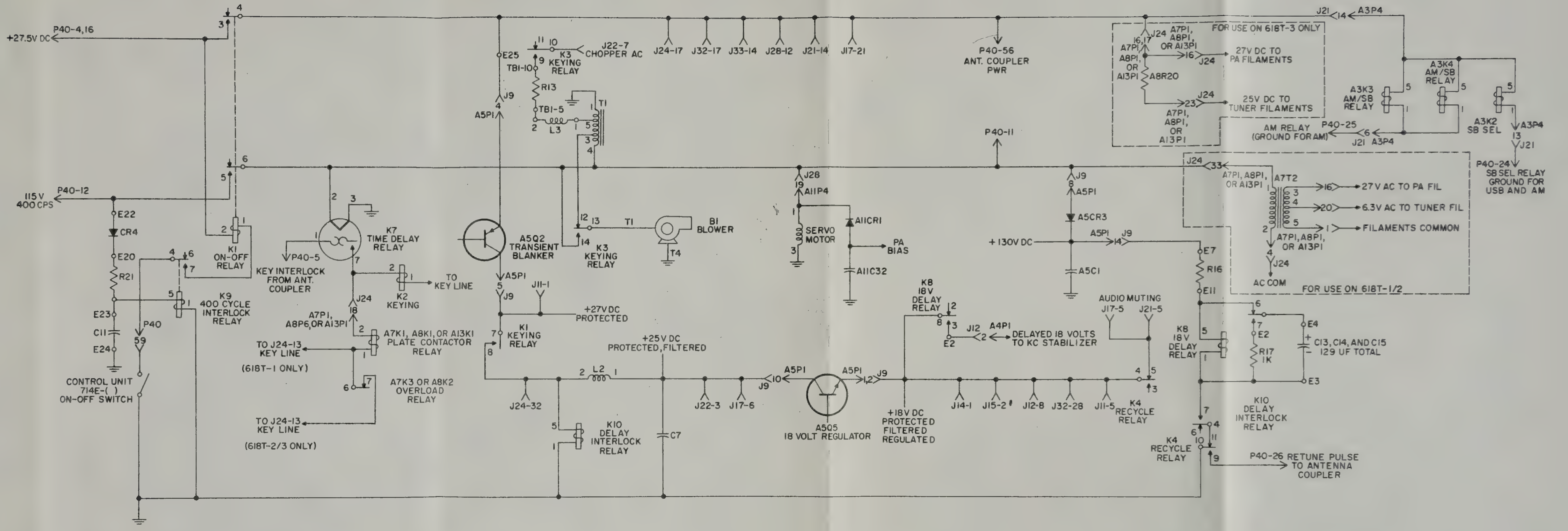
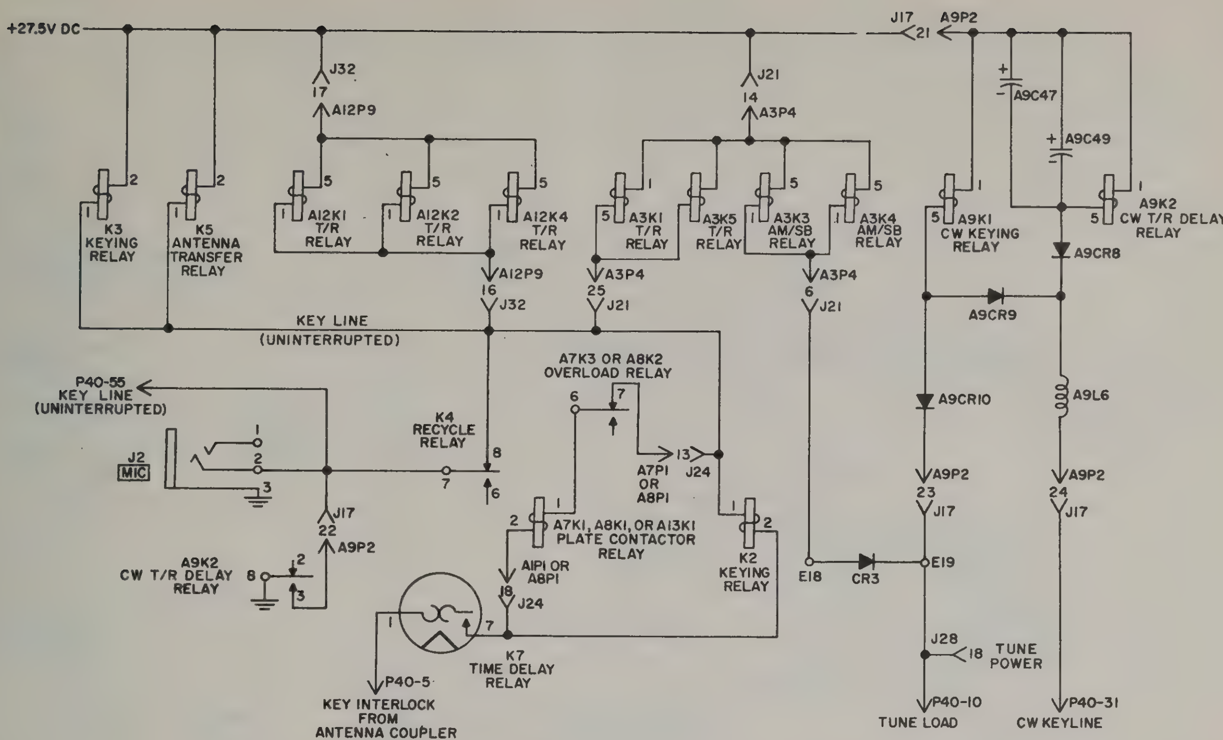


Power Distribution Circuits,
Simplified Schematic Diagram
Figure 27

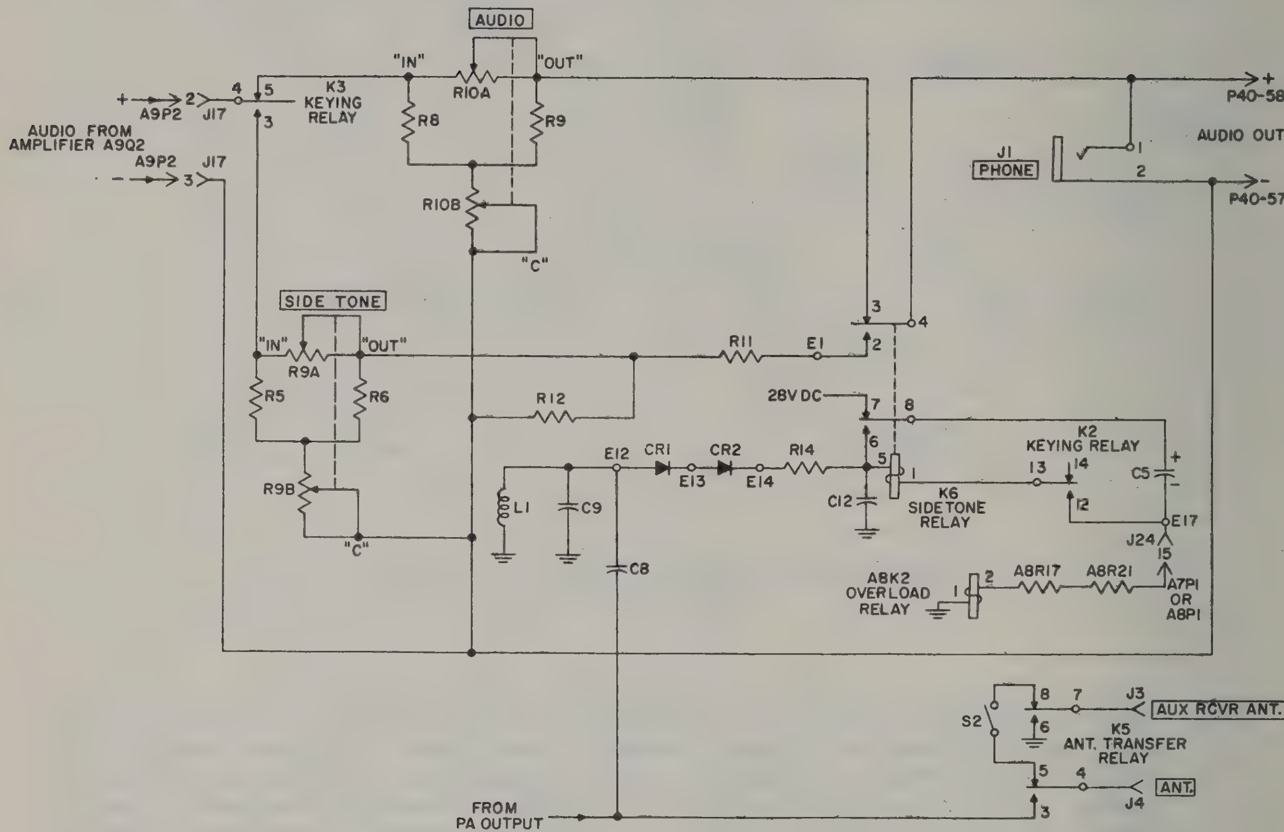


Keying Circuits, Simplified Schematic Diagram
Figure 28

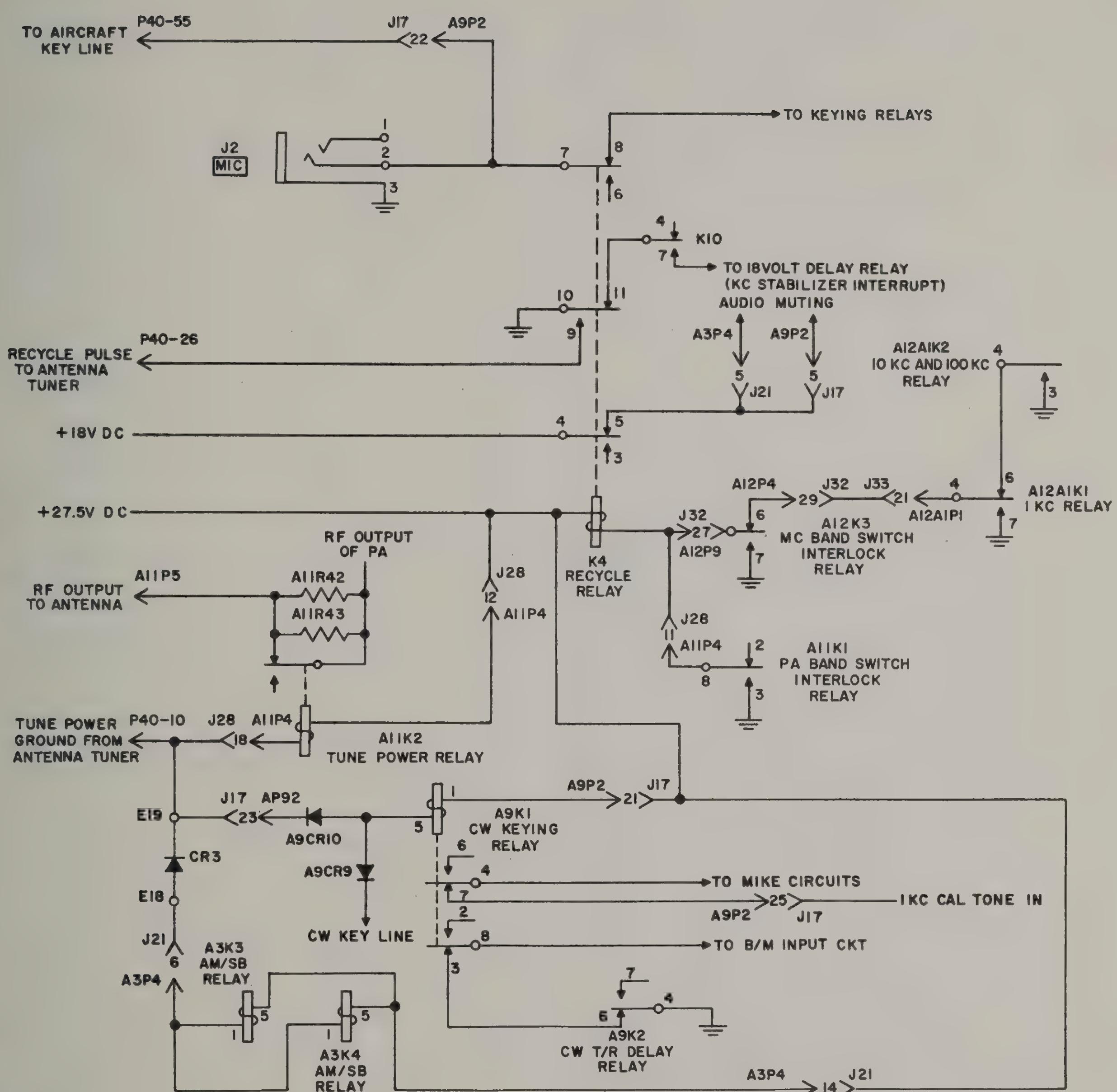
CR1 and CR2, filtered by C12, and applied to the sidetone relay coil. The second voltage, from the high-voltage power supply module, is proportional to the power amplifier plate current. This voltage is the same one that is used for tgc control in the i-f translator module. In order for the sidetone relay to be energized, both sufficient plate current and plate voltage swing must be present in the power amplifier. C5 is placed across the coil of the sidetone relay to keep the relay energized in the sideband transmit mode when the plate current varies with the applied audio signal.

(5) Recycle Circuits.

Figure 30 is a simplified schematic diagram of the recycle circuits in the 618T-( ). These circuits are activated when any of the frequency selector knobs on the control unit are turned. When the knobs are turned, the recycle relay is energized. This relay remains energized as long as any of the tuning motors in the 618T-( ) are operating. The recycle relay (1) disconnects transistor supply voltage to the audio amplifier to mute the audio during the tuning cycle, (2) provides a ground to activate the antenna tuner, (3) interrupts the operation of the kilocycle stabilizer during the tuning cycle, and (4) disconnects the keying so that the transmitter cannot be keyed during the tuning cycle.



Sidetone Circuits, Simplified Schematic Diagram
Figure 29



Recycle Circuits, Simplified Schematic Diagram
Figure 30

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CHAPTER 3

DISASSEMBLY

CHAPTER 3

DISASSEMBLY

Table of Contents

List of Illustrations

1. GENERAL.

The disassembly procedures for Airborne SSB Transceiver 618T-( ), contained in this chapter. should be followed only when it is necessary to remove a part in order to repair or replace it. The 618T-( ) should not be disassembled completely as a routine part of the overhaul procedure.

2. GENERAL TECHNIQUES AND PRECAUTIONS IN DISASSEMBLY OF AIRBORNE SSB TRANSCEIVER 618T-( ).

Standard electrical disassembly techniques apply to Airborne SSB Transceiver 618T-( ). However, special attention should be given to the following techniques:

A. Removal of Electrical Wiring.

Tag or otherwise identify all disconnected electrical wiring. Make a note of color coding, placement of wires, and method of insulation (if any) before unsoldering or removing.

B. Removal of Transistors and Diodes.

When removing transistors or diodes, use long-nosed pliers to grasp the lead to which heat is applied between the solder joint and the component. This will bleed off some of the heat that conducts into the component from the soldering iron.

C. Removal of Printed Circuit Boards.

Printed circuit boards may be removed from the module chassis by removing the screws which fasten the boards to the spacers on the module chassis. Be careful when removing circuit boards to not damage any connecting wiring or components that are mounted on the board. Refer to the repair section for information regarding removal of components from printed circuit boards.

3. SPECIFIC DISASSEMBLY TECHNIQUES.

A. Removal of Side Covers, Front Panel Cover, and Front Panel.

(1) Modules may be exposed by removing the two side covers on the 618T-( ). To do this, loosen four screws, two on each side, at rear of transceiver. Side covers then may be lifted off.

(2) The front panel cover may be removed by turning the two Dzus fasteners on the cover and pulling cover forward. This will expose the blower filter, sidetone level adjusting screw, and audio level adjusting screw.

(3) To expose the components on the rear of the front panel and in the relay compartment on the front of the chassis, remove four screws at the four corners of the front panel. The front panel then may be moved to expose the components, but will remain attached to the main chassis by a wiring cable.

B. Removal of Module Covers and Modules.

(1) Module covers may be removed by pulling the one or two small handles that are riveted to the cover. It is not necessary to remove any screws to remove the module covers.

(2) Remove modules from the chassis by loosening the redheaded captive hold-down screws at the corners of the module and pulling straight out. Use module pullers, Collins part number 546-6463-002.

CAUTION: DO NOT TWIST OR PRY ON MODULE TO DISENGAGE MATING CONNECTORS, OR CONNECTORS MAY BE DAMAGED.

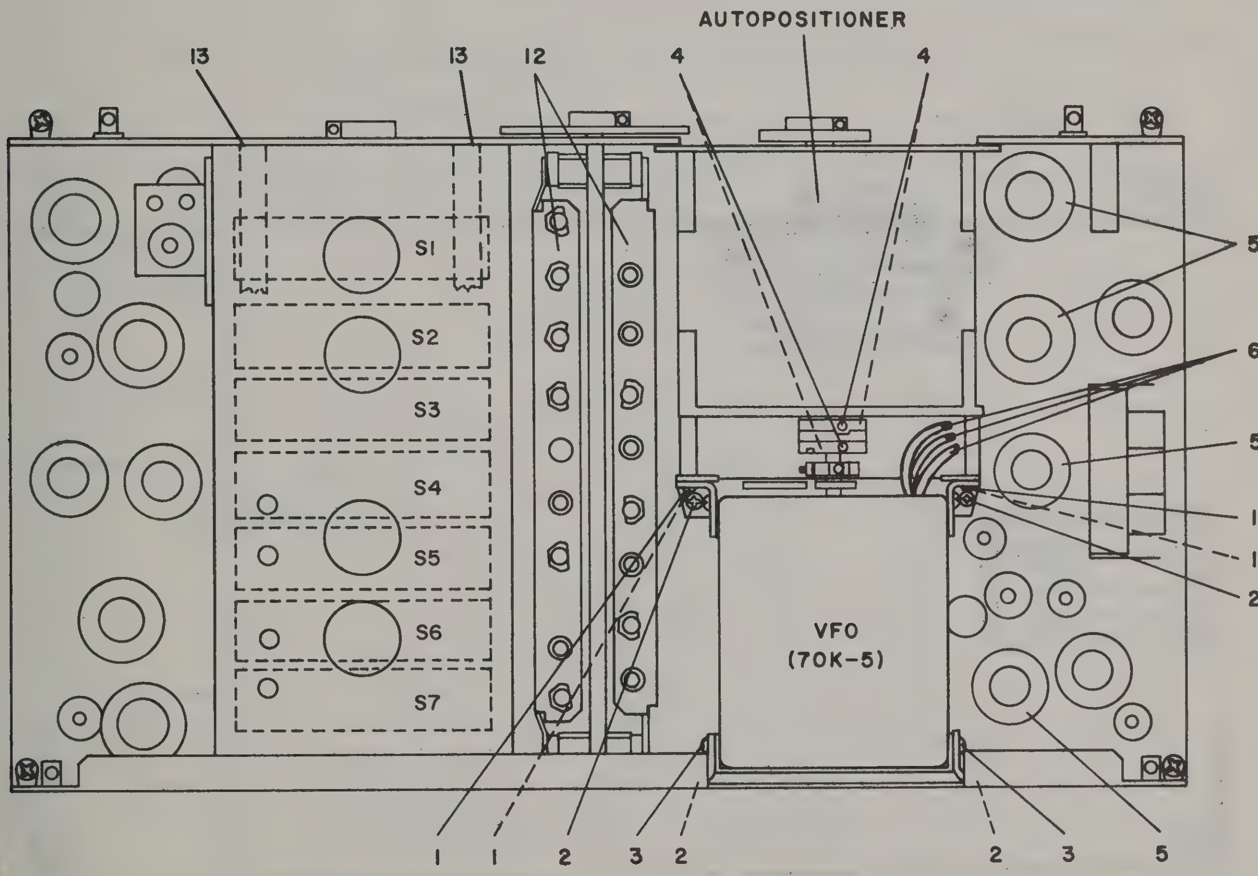
C. Removal of VFO and Autopositioner from R-F Translator Module.

(1) With r-f translator module in the chassis and power applied to the 618T-( ), position the vfo and Autopositioner to 500-kc position by setting frequency indicator on Control Unit 714E-( ) to 0.500 mc, any megacycle band.

(2) Remove r-f translator module from the 618T-( ) chassis.

(3) Remove top and bottom covers from r-f translator module.

(4) Refer to figure 101. Remove four screws (1) fastening vfo to the Autopositioner.



R-F Translator Module, Top View
Figure 101

(5) Remove four screws (2) fastening vfo brackets to r-f translator chassis and back plate.

(6) Loosen two screws (3) holding back brackets on vfo. Rotate brackets approximately 90 degrees in order to get room to move vfo.

(7) Loosen four setscrews (4) on coupler between vfo and Autopositioner.

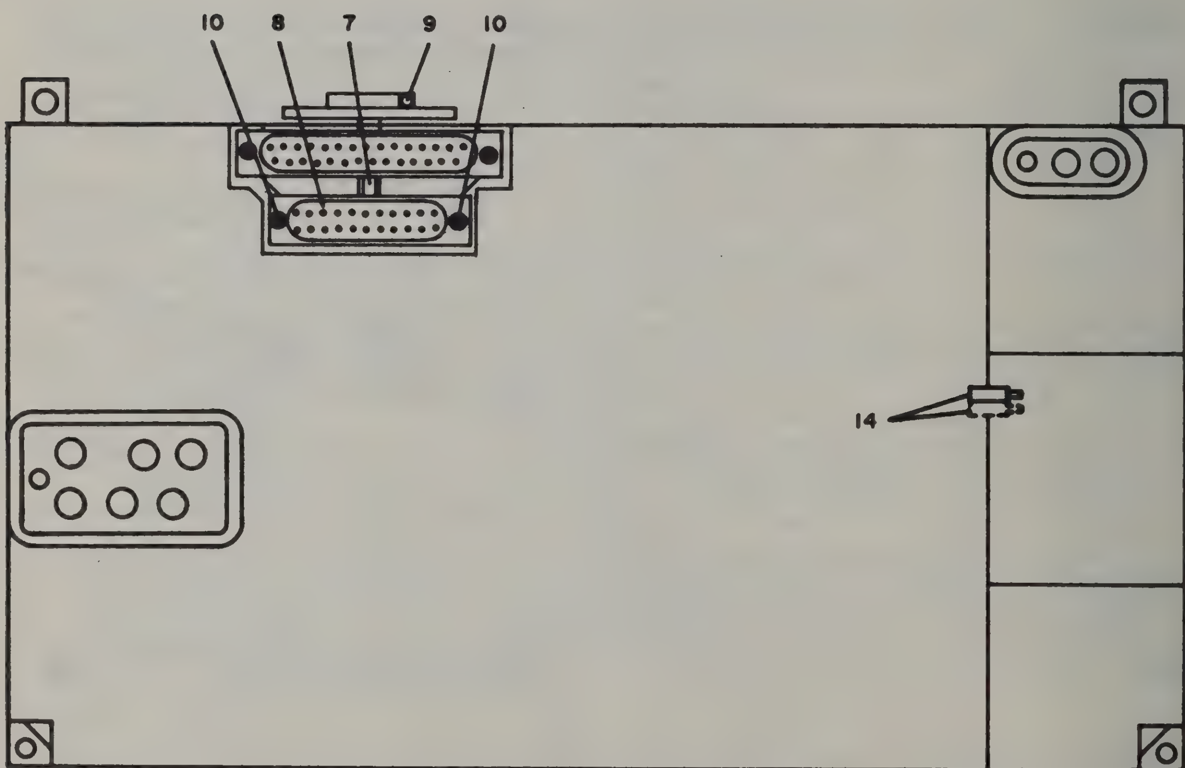
(8) Remove four tubes (5) adjacent to vfo and Autopositioner.

(9) To remove the vfo, tag and unsolder the three vfo leads (6) from connectors P6 and J32-31 and the other internal connections in the module. Note placement of these leads on r-f translator chassis. The vfo may then be lifted from r-f translator.

(10) Refer to figure 102. Remove 3/8-inch flatted shaft (7) directly above 25-pin connector (8) by loosening clamp (9) on gear that drives the shaft. Pull shaft out through gear.

(11) Remove two screws (10) holding 25-pin connector to bottom of r-f translator chassis.

(12) Remove idler gear which couples Autopositioner to slug rack gear. Idler gear is G9 in figure 103.



R-F Translator Module, Bottom View
Figure 102

(13) Refer to figure 103. Remove four screws (11) holding Autopositioner to gear plate.

(14) Carefully maneuver Autopositioner to free it from mounting plate. Remove Autopositioner by slowly lifting it from r-f translator chassis. Be careful to not damage 28-position switch wafers when pulling 25-pin connector up through chassis.

D. Disassembly of VFO.

The vfo is a potted assembly and cannot be disassembled in the field. Any attempt to disassemble or adjust the vfo will result in misalignment and loss of accuracy. If the source of trouble has been definitely traced to the vfo, the vfo should be returned to the factory and replaced with a new unit.

E. Disassembly of Autopositioner.

(1) Removal of Reversing Switch.

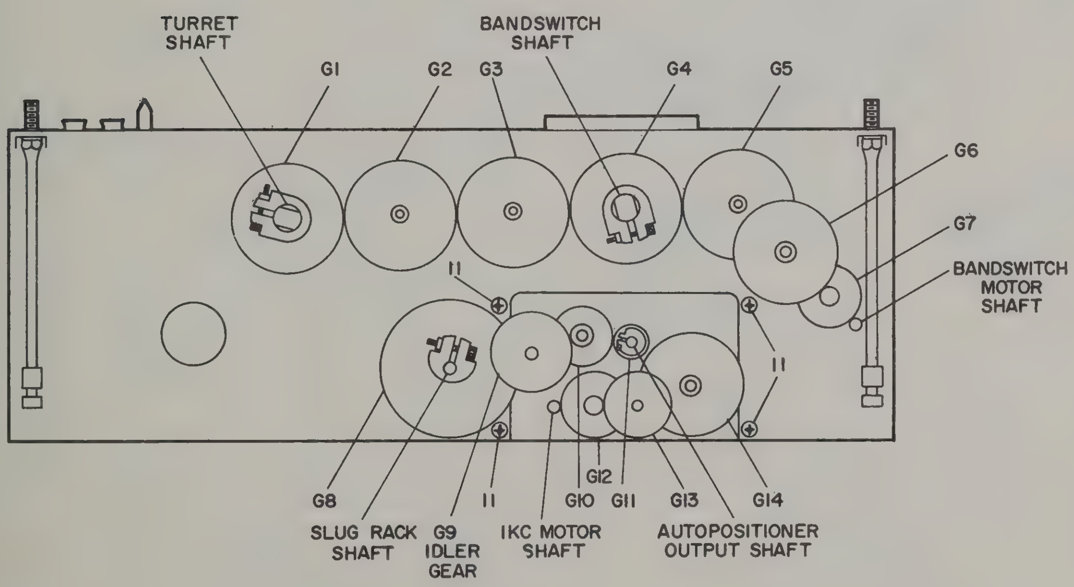
(a) Refer to figure 104. Rotate gear (1) or (5) by hand to position cam (32) so that cam follower (98) is as near camshaft (31) as possible.

CAUTION: ALWAYS TURN GEARS SO THAT CAM ROTATES IN COUNTER-CLOCKWISE DIRECTION AS VIEWED FROM GEAR-PLATE SIDE.

(b) Remove spring (138) by unhooking bar (137) that is held in slots on mounting posts (135). Do not stretch spring excessively while removing it.

(c) Remove cable clamp (21) by removing screw (26).

(d) Remove cable clamp (89) by removing screw (90) and washer (91). Lay cable back so that reversing switch (87) is accessible.



R-F Translator Module, Gear Plate
Figure 103

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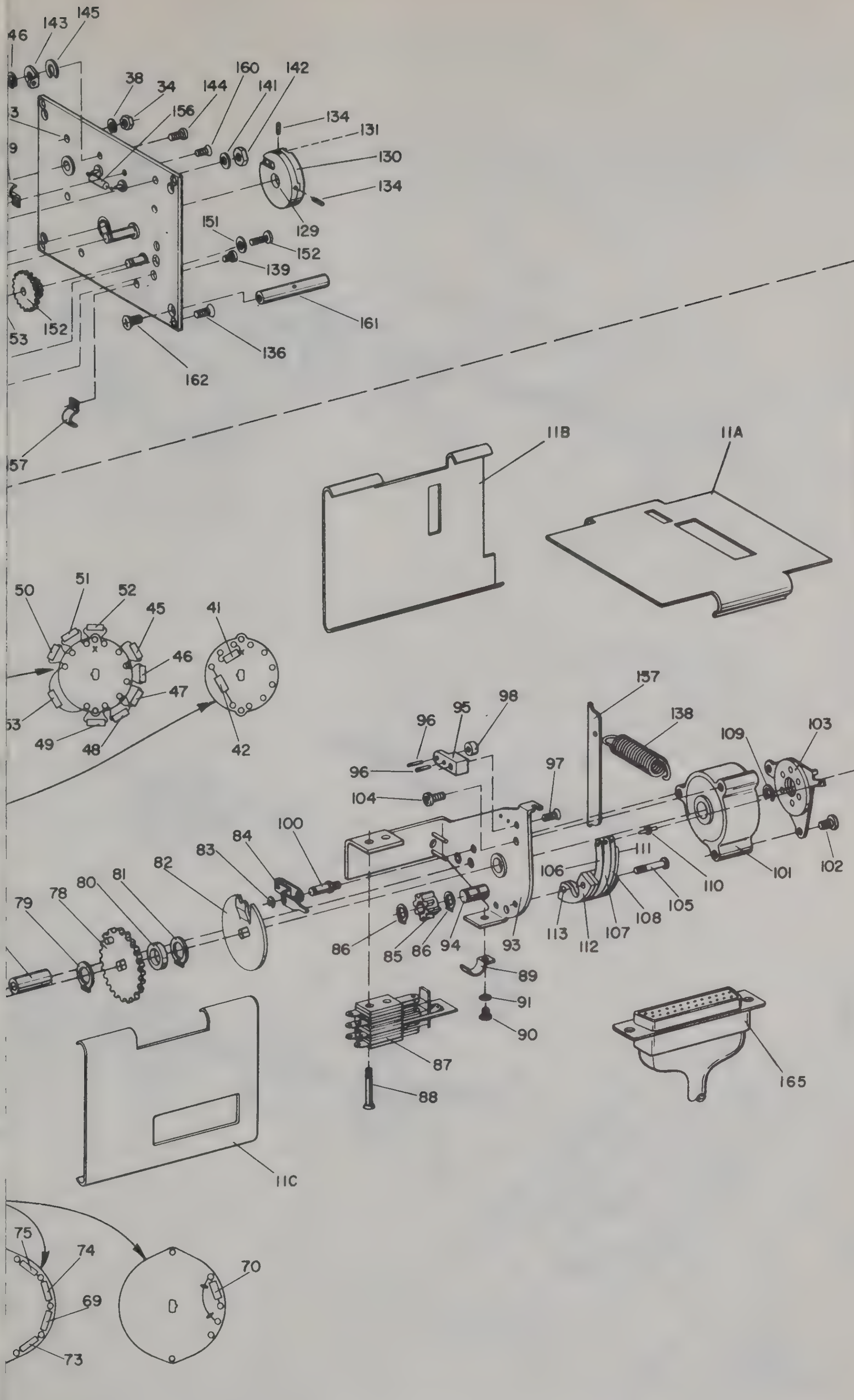

Autopositioner Submodule, Exploded View
Figure 104

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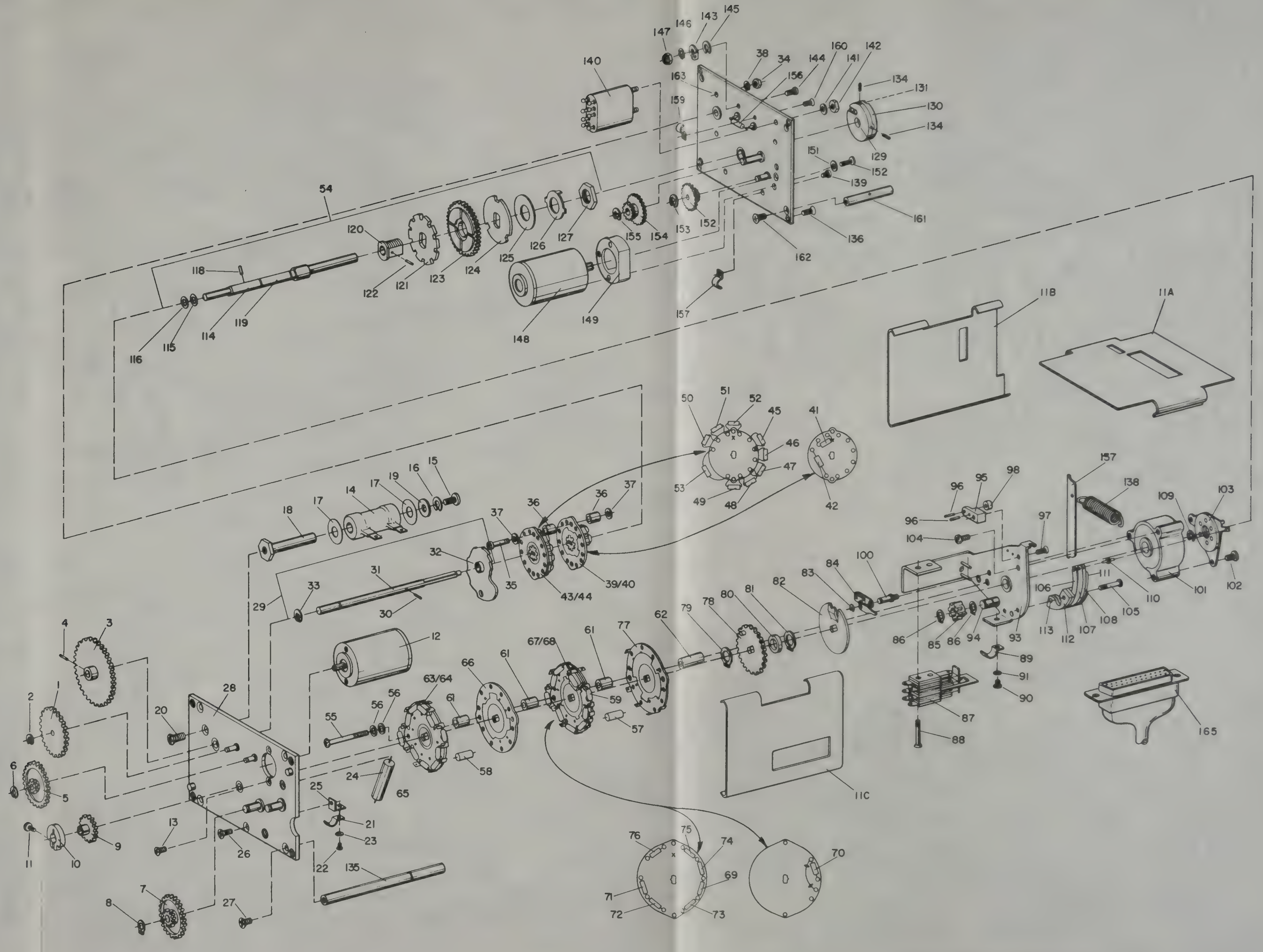


Autopositioner Submodule, Exploded View
Figure 104

(e) Remove two screws (88) holding switch to bracket (93). Remove reversing switch from bracket.

(f) Tag and unsolder the six wires connected to the switch. Reversing switch terminal identification is given in figure 105(A). The switch may now be removed.

(2) Removal of 1-Kc Switches.

(a) Refer to figure 104. Rotate gear (1) or (5) by hand to position cam (32) so that cam follower (98) is as near camshaft (31) as possible.

(b) Remove spring (138) by unhooking bar (137) that is held in slots on mounting posts (135).

(c) Remove vfo coupler (130) from output shaft (119) by loosening two setscrews (134).

(d) Remove two cable clamps (157) by removing two screws (139).

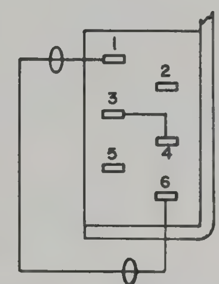
(e) Remove relay (140) from mounting plate (163) by removing two nuts (142) and two washers (141).

(f) Remove motor (148) and motor bracket (149) from mounting plate by removing two screws (151) and two washers (150).

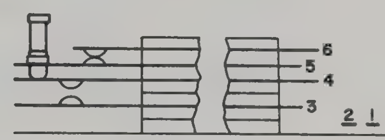
(g) Loosen mounting plate (163) by removing four screws (136). Lift plate straight up to clear output shaft (119) and 1-kc switch shaft (31).

(h) Remove 1-kc switch wafers (43/44, 39/40) from mounting plate by removing two screws (35). Be careful to not lose any of the small ceramic spacers (36) or fiber washers (37).

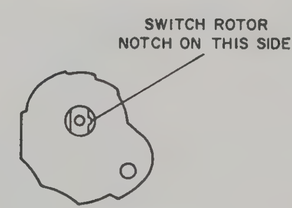
(i) Tag any leads before unsoldering from switch terminals. Refer to figure 106(B).



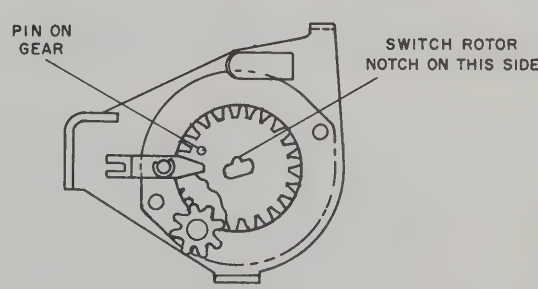
(A) REVERSING SWITCH TERMINAL IDENTIFICATION



(B) SOLENOID RELAY TERMINAL IDENTIFICATION

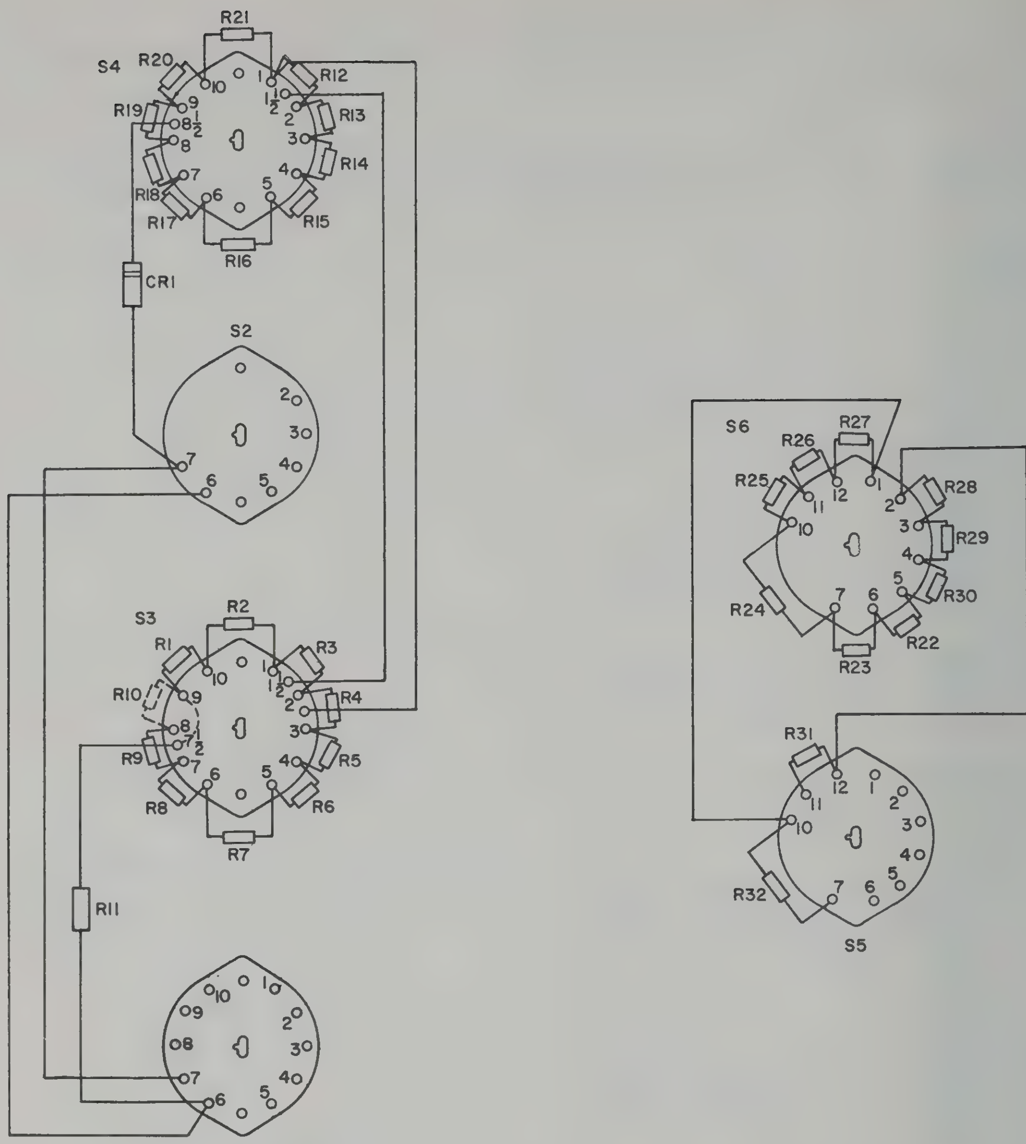


(C) I KC SWITCH ALIGNMENT



(D) IO KC SWITCH ALIGNMENT

Autopositioner Alignment
Figure 105



(A) 10KC SWITCHES

(B) 1KC SWITCHES

Autopositioner Switch Identification
Figure 106

(3) Removal of 10-Kc and 100-Kc Switches.

(a) Perform steps (a) through (g) of paragraph 3.E.(2).

(b) Refer to figure 104. Rotate gear (1) or (5) by hand to position cam (32) so that screw (15) holding resistor (14) to gear plate (28) is accessible.

(c) Remove screw (15) holding resistor (14) to gear plate. Note placement of resistor leads. Do not lose washers at the ends of this resistor.

(d) Remove cable clamp (21) by removing screw (26).

(e) Remove output shaft gear (9) by loosening setscrew (11) in clamp (10) and pulling straight off.

(f) Pull output shaft out of the hole in the gear plate. Be careful to not lose the shim washers (if any) between the output shaft and the gear plate. The switch assembly is now free of the Autopositioner chassis.

(g) Remove cable clamp (89) by removing screw (90) and washer (91).

(h) Remove reversing switch (87) by removing two screws (88).

(i) Tag and unsolder the six wires connected to the solenoid (101) and solenoid relay terminals (112). Solenoid relay terminal identification is given in figure 105(B).

(j) Remove two screws (55) and washers (56) holding switch wafers (63/64, 66, 67/68, 77) to bracket (93). Switch wafers may now be removed. Tag any leads before unsoldering from switch terminals. Refer to figure 106(A).

(4) Disassembly of Clutch Assembly.

(a) Perform steps (a) through (f) of paragraph 3.E.(3).

(b) Refer to figure 104. Bend down tabs on washer (126) under nut (127). Remove nut (127), washer (126), and spring washer (125).

(c) Remove clutch disc (124) and clutch gear (123).

CAUTION: DO NOT TOUCH CLUTCH SURFACES WITH FINGERS. KEEP SURFACES FREE OF DUST, DIRT, AND LUBRICANTS OF ANY KIND.

(5) Removal of Solenoid.

(a) Perform steps (a) through (j) of paragraph 3.E.(3) and steps (b) and (c) of paragraph 3.E.(4).

(b) Refer to figure 104. Remove pin (122) through hub (120) and shaft (119) with a punch. Slide hub (120) and attached notched wheel (121) off shaft.

(c) Remove pawl plate (103) from solenoid (101) by removing two screws (102). Be careful not to lose small fiber actuator (110) that separates pawl plate (103) from solenoid relay contacts (108).

(d) Remove retaining ring (109) from shaft (119).

(e) Unsolder the insulated jumper wire from terminal 2 of solenoid. See figure 105(B).

(f) Remove solenoid (101) from the bracket (93) by removing two screws (104) and post (100).

F. Removal of Turrets from R-F Translator Module.

(1) With r-f translator module in the chassis and power applied to the 618T-( ), position turrets to the 2-megacycle position by setting frequency indicator on Control Unit 714E-( ) to 2.000 mc.

(2) Remove r-f translator module from 618T-( ) chassis.

(3) Remove top and bottom covers from r-f translator module.

(4) Remove turret cover by removing 14 screws on cover.

(5) Refer to figure 101. Remove two phenolic aligning posts (13) by removing two screws on rear of module. Slide rods out through gear plate.

(6) Remove turret shaft by loosening clamp on gear that drives the shaft. Pull shaft out through gear.

(7) Remove turrets at bottom of r-f translator by pushing them from top of module. Use care to avoid catching spring contacts, extending from the turret faces, in the shaft holes.

G. Disassembly of Power Amplifier Module.

(1) Refer to figure 107. Remove seven screws (S) from gear plate.

(2) Remove top cover plate from module by loosening 17 screws on cover, sliding it toward the gear plate, and lifting it off.

(3) Remove square plate on end of module opposite gear plate by removing eight screws.

(4) Remove two nylon screws and washers holding roller coil assembly to bracket at end of roller coil nearest tubes. Push the screen bypass capacitor out of the way to get at these screws.

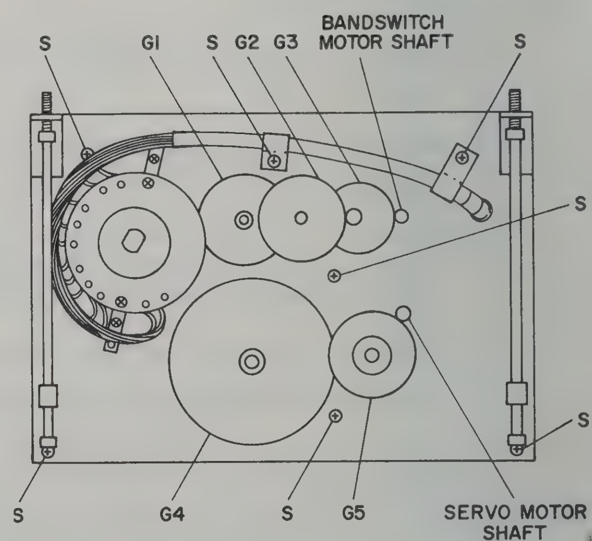
(5) Remove one screw and washer holding end of the large silver-plated coil to bracket on roller coil assembly.

(6) Loosen one screw holding lower strap on roller coil assembly.

(7) Pull gear plate out from chassis. Be careful to pull straight out because band-switch shaft comes out with gear plate. Gear plate will remain connected to module chassis by wiring cable.

(8) To remove power amplifier tubes, remove tube cover plate from end of module opposite gear plate by removing six screws. Loosen straps around tubes. Remove tubes with tube pullers supplied in Maintenance Kit 678Y-1.

NOTE: Short plate straps to chassis with an insulated-handle screwdriver before removing tubes.



Power Amplifier Module, Gear Plate
Figure 107

H. Removal of Crystal from R-F Oscillator Module.

(1) Remove r-f oscillator module from 618T-( ) chassis.

(2) Remove dust cover from module.

(3) Remove triangular-shaped cover plate from top of module by removing four screws.

(4) Remove two hold-down screws on the foam-insulated end of module.

(5) Remove foam plug from top of module. Pull wire cable so that it is outside insulation.

(6) Tilt insulating foam so that the bottom of foam is exposed.

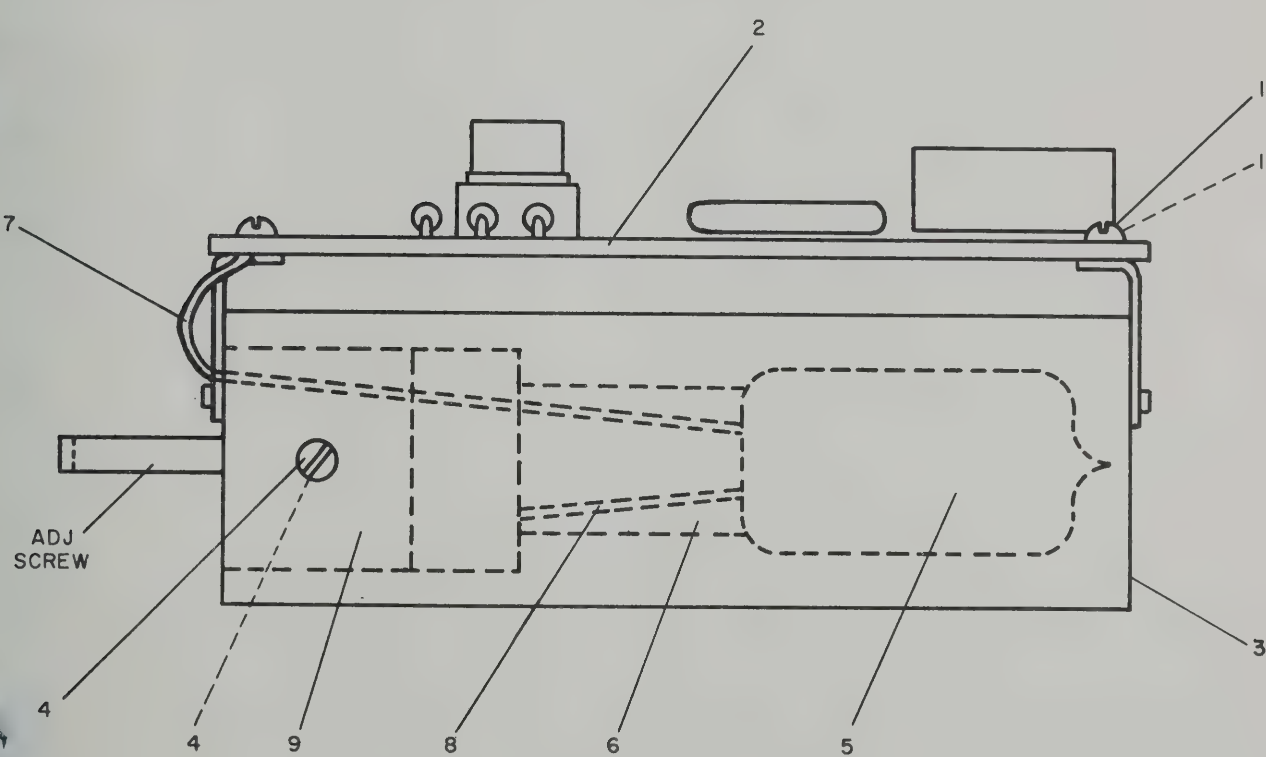
(7) Remove foam plug from bottom of module. Pull wire cable so that it is outside foam.

(8) With a finger, push oven and crystal oscillator assembly up through foam. Do not use a tool to push oven out of foam, or oven may be damaged.

(9) Refer to figure 108. Remove two screws (1) from circuit board (2) to loosen oven assembly (3).

(10) Remove two screws (4) from opposite sides of oven.

(11) Hold circuit board in one hand, and remove oven to expose crystal (5).



Oven and Crystal Oscillator Assembly, R-F Oscillator Module
Figure 108

(12) Remove all grease (6) from around crystal. Wipe all grease from crystal. Do not get grease on circuit board.

(13) Unsolder green crystal lead (7) from circuit board.

(14) Unsolder blue crystal lead (8) from C1 (9). Crystal may now be removed.

CHAPTER 4

CLEANING

CHAPTER 4

CLEANING

Table of Contents

Table

1. GENERAL.

This chapter contains instructions and procedures for cleaning Airborne SSB Transceiver 618T-( ).

2. CLEANING AGENTS.

The word "solvent" in this section shall mean a mixture composed of 25 percent methylene chloride, 5 percent perchloroethylene, and 70 percent dry-cleaning solvent, Federal Spec P-S-661a. All percentages are by volume.

References to an air jet in this section refer to a hand-operated air nozzle supplied with clean, dry, compressed air at a maximum pressure of 28 psi. All cleaning materials are listed in table 1.

WARNING: PERFORM ALL OPERATIONS INVOLVING CLEANING SOLVENT IN A VENTILATED HOOD. AVOID BREATHING SOLVENT VAPOR; WEAR A SUITABLE MASK WHEN NECESSARY. AVOID CONTINUOUS CONTACT WITH THE SOLVENT. USE GOGGLES, GLOVES, AND AN APRON TO PREVENT IRRITATION DUE TO PROLONGED CONTACT. CHANGE CLOTHING WHICH HAS BECOME SATURATED WITH SOLVENT. OBSERVE ALL FIRE PRECAUTIONS FOR FLAMMABLE MATERIALS. THESE MATERIALS SHOULD BE USED IN A HOOD PROVIDED WITH EXPLOSION-PROOF ELECTRICAL EQUIPMENT AND AN EXHAUST FAN WITH SPARKPROOF BLADES. WEAR GOGGLES WHEN BLOWING DUST OR DIRT FROM EQUIPMENT PARTS WITH AIR JET. OTHER PERSONS SHOULD BE WARNED AWAY FROM HAZARDOUS AREA OR WORKING ENCLOSURE.

TABLE 1. CLEANING MATERIALS

MATERIAL	SPECIFICATION	ASO STOCK NO.
Solvent:		
A mixture (by volume) of		
Methylene chloride, 25%	ANA Spec. AN-M-37	R51-M-950-20
Perchloroethylene, 5%	Fed. Spec. 0-T-236	R51-T-4459-200
Dry-cleaning solvent, 70%	Fed. Spec. P-S-661a	R51-C-1326-75
Alcohol	MIL-A-6091A	
Chamois skin		
Cloth, cotton, lintless		
Detergent, powder		
Burnishing tool		
Tissue paper		
Brush, small, soft-bristled (camel's hair)		

3. CLEANING PROCEDURES.

A. Chassis and Modules.

(1) Remove dust and dirt from all surfaces, including wiring and small parts, with a soft-bristled brush and air jet.

NOTE: When it is necessary to distrub dress of wiring and cables, restore them to their proper position when cleaning is completed.

(2) Wipe all finished surfaces with a solvent-moistened, lintless cloth. Dry and polish these surfaces with a dry, clean, lintless cloth.

(3) Make touch-up repairs, if required, to minor damages of the finish.

B. Connectors and Receptacles.

(1) Wipe dust and dirt from bodies, shells, and cable clamps with a solvent-moistened, lintless cloth. Wipe dry with clean, dry lintless cloth.

(2) Remove dust from inserts with soft-bristled brush and air jet.

(3) Wash dirt and any traces of lubricant from insert, insulation, and contacts with solvent. Apply solvent sparingly with small camel's-hair brush.

CAUTION: DO NOT ALLOW SOLVENT TO RUN INTO SLEEVES (OR CONDUIT) COVERING ANY WIRES OR CABLES CONNECTED TO CONTACT TERMINALS OF THE INSERT. DO NOT USE METAL TOOLS TO REMOVE FOREIGN MATTER FROM THESE CONTACTS.

(4) Dry inserts with air jet.

C. Shockmounts and Dust Covers.

(1) Blow dust from surfaces with air jet.

(2) Wipe away any remaining dust or grease with a solvent-moistened, lintless cloth.

(3) Make up a washing bath by dissolving two ounces of detergent powder per gallon of warm water. Immerse mount or cover in bath and agitate for several minutes.

(4) Rinse mounts in warm water, drain, and dry with air jet.

D. Relay Contacts.

(1) Clean dirty (not pitted or burned) contacts with a burnishing tool. Before using tool, clean its surface with alcohol. Do not touch this surface with fingers before using tool.

CAUTION: CONTACT SUPPORTING MEMBERS SHOULD NOT BE BENT OR FORCED BEYOND THEIR NORMAL OPERATING LIMITS WHILE BURNISHING CONTACTS.

(2) Remove dust and dirt with soft-bristled brush and air jet. Operate relay armature manually while blowing on contacts.

(3) Wash all surfaces of contacts with alcohol applied with a clean camel's-hair brush.

(4) Dry contacts with air jet, then remove any whitish film residue by passing small strips of clean white paper back and forth between each pair of contacts while holding them closed with light finger pressure.

E. Rotary Switch Contacts.

(1) Remove all dust with air jet, turning switch rotor back and forth several times while blowing.

(2) Wash all contacts and insulation with alcohol. Apply lightly with small camel's-hair brush.

(3) Dry with air jet, then repeat wash, using clean alcohol, and rotating switch rotor several times during this wash.

(4) Dry gently but thoroughly with air jet.

F. Mechanical Metal Parts (Including Teflon Gears).

(1) Remove bulk of any surface grease with rags.

(2) Blow dust from surfaces, holes, and recesses with air jet.

(3) Immerse the part in a washing bath of solvent, and scrub until clean. Clean all surfaces and recesses with a nonmetallic brush.

(4) Raise from the bath and drain.

(5) Immerse in a rinsing bath of clean solvent. Raise from bath and position to drain dry.

G. Printed Circuit Boards.

(1) Use an air jet and camel's hair brush to blow and brush dust and dirt from surfaces, holes, and crevices.

(2) Wipe clean with a lintless cloth which has been slightly moistened with solvent.

CAUTION: THE MOISTURE SEALANT ON THE PRINTED CIRCUIT BOARDS WILL SOFTEN IF SOLVENT IS APPLIED FOR TOO LONG OR IF TOO MUCH SOLVENT IS USED. BE CAREFUL WHEN CLEANING CIRCUIT BOARDS TO DRY THEM WITH A CLEAN, LINTLESS CLOTH IMMEDIATELY AFTER CLEANING WITH SOLVENT-MOISTENED CLOTH.

H. Blower Filter.

The blower filter should be cleaned regularly. Always clean filter before air-outlet side becomes dirty.

(1) Slowly immerse filter, dirty side up, in cool water to which a mild detergent has been added. This will float out dirt and lint. A slight up-and-down motion will remove any remaining particles. If it is impossible to immerse filter, pass a fine spray of water through it in the direction opposite that of air flow.

(2) Shake filter to remove excess water. Allow to drain dry.

(3) Before replacing cleaned, dry filter, lightly coat all filter surfaces with Air-Maze Filterkote "M" Water Soluble Oil, Collins part number 005-0609-00.

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CHAPTER 5

INSPECTION CHECKS

CHAPTER 5

INSPECTION CHECKS

Table of Contents

1. GENERAL.

This chapter gives inspection procedures for the disassembled and cleaned equipment. Any portion of the equipment which does not pass inspection should be noted for repair or replacement.

2. DUST COVER.

Examine dust cover for deformations, punctures, deep dents, and badly worn surfaces. Also check for damaged fastening devices or handles. Examine for corrosion and damage to finish.

3. CHASSIS.

Check for physical damage and deformation. Also check for corrosion and any damage which would require replating or refinishing.

CAUTION: CHECK TO SEE THAT ALL GASKETS ON THE CHASSIS PLENUM COVER AND R-F TRANSLATOR AND POWER AMPLIFIER MODULES ARE IN PLACE AND IN GOOD CONDITION. THE PRESENCE AND PROPER CONDITION OF THESE GASKETS ARE VITAL TO PROPER COOLING-AIR FLOW.

4. SHOCKMOUNT.

A. Place a 618T-( ) on the shockmount under inspection.

B. Check equipment in its normal loaded position. Check for any noticeable sagging of any of resilient mounts.

C. Depress equipment until resilient mounts are at a bottom position. Resilient mounts should permit a minimum travel of 1/16 inch.

D. Lift up on equipment until mounts are at an upward position. Resilient mounts should permit a minimum travel of 1/16 inch.

5. CONNECTORS.

Examine connector for cracked or broken insulation and for contacts which are broken, deformed, or out of alignment. Check also for corroded or damaged plating or contacts and for loose, poorly soldered, broken, or corroded terminal connections.

6. RECEPTACLES.

Examine receptacles for cracked, broken, or charred insulation. Also check for damage to parts, loose or bent contacts, corrosion, and other abnormal conditions.

7. BALL BEARINGS.

A. Check for blue or purple discoloration of any part of bearing due to burning.

B. Check for tarnished external surfaces. This is indicated by a light discoloration of the highly finished surfaces.

C. Check for rust.

D. Check for flat bearing balls, broken ball separators, flaking or spalling of load-carrying surfaces, and other abnormal conditions by noise inspection.

8. GEARS.

A. Inspect all gears visually. Presence of a sharp burr on one side of gear at edges of teeth indicates tooth wear. A change in face width due to this burr means that replacement is necessary.

B. Inspect all gears for broken, chipped, or badly worn teeth.

C. Inspect gear bodies for cracks and deformation.

D. Inspect gear bore for excessive wear.

E. Inspect surfaces for corrosion or other abnormal conditions.

9. PRINTED CIRCUIT BOARDS.

A. Inspect for loose, broken, corroded, or poorly soldered terminal connections.

B. Inspect printed circuits for any evidence of damage, such as burned, broken, cracked, or corroded plating.

C. Inspect for complete moisture sealant coating of printed circuit boards.

10. RELAYS (OPEN).

A. Examine relay contacts for burned or pitted areas, welds, misalignment, and improper separation.

B. Check contact support members for deformation causing a defect, misalignment, or improper contact operation.

C. With the finger, test movable contacts for sluggish action or sticking at any point of travel in either direction. Examine for physical damage to armature. Also check for foreign matter between end of pole piece and armature.

D. Examine for loose coil, corrosion, loose leads or terminals, and for cuts and damage to coil.

E. Examine for loose, broken, brittle, or charred insulation on coil or leads, between contact support members, and between terminals on relay.

F. Examine for bent, loose, or broken terminals.

G. Check relay mountings and mechanical parts for looseness and physical damage or corrosion.

11. FIXED-COMPOSITION AND WIRE-WOUND RESISTORS.

Examine these resistors for cracked, broken, blistered, or charred bodies and loose, broken, poorly soldered, or corroded terminal connections.

12. VARIABLE RESISTORS.

Examine variable resistors for corrosion of shafts, cases, and other visible parts; loose mountings; and physical damage. Some variable resistors used in the 618T-( ) have shafts mounted on friction clutches to prevent damage to the resistor if shaft is forced. Therefore, if resistor is forced against the end stop, the shaft will continue to rotate in clicks. This is normal and not cause for replacement.

13. R-F COILS.

Inspect r-f coils for broken leads; loose, poorly soldered, or broken terminal connections; and loose mountings. Also check for crushed, scratched, cut, bruised, or charred windings; for corrosion on windings, leads, terminals, and connections; and for physical damage to forms and tuning-slug adjustment screws.

14. TUBE SOCKETS.

A. Examine for loose, broken, missing, or improperly seated mounting rings. Also check for cracked, broken, or charred insulation.

B. Examine for broken, deformed, or corroded contacts and loose, poorly soldered, broken, or corroded terminal connections.

15. SOLDERED TERMINAL CONNECTIONS.

A. Examine for cold-soldered or resin joints. These joints appear rough, porous, or dull. Check for strength of bond with the point of a tool.

B. Examine for excess solder, protrusions from joints, pieces adhering to adjacent insulation, and particles lodged between joints, conductors, or other parts.

16. ROTARY SWITCHES.

A. Inspect insulation for cracks, breaks, or charring.

B. Check movable and stationary contacts for deformation, breakage, and wear and for burning, pitting, and corrosion.

C. Inspect terminals for loose, poorly soldered, broken, or corroded connections.

D. Examine mechanical parts for damage or corrosion and for irregular or rough action.

17. TRANSFORMERS AND REACTORS.

Examine these parts for signs of excessive heating, physical damage to case, cracked or broken insulators, and other abnormal conditions. Also check for corroded, poorly soldered, or loose terminals and loose, broken, or missing mounting hardware.

18. VACUUM TUBES.

A. Examine envelope for cracked glass or dented metal, separation from base, and obliterated markings.

B. Check base for cracked, chipped, or broken body or key and for charring of base between contacts.

C. Examine for loose caps and deformed, broken, or misaligned base contacts. Also check for corrosion or other damage to contact plating and for loose or missing solder tips of tubular-type contacts.

19. WIRING.

Check open and laced wiring on chassis, terminal boards, and parts of equipment by checking insulation for physical damage and charring. Examine wires for breakage and for improper dress in relation to adjacent wiring or chassis.

CHAPTER 6

REPAIR

CHAPTER 6

REPAIR

Table of Contents

1. GENERAL.

The repair or replacement of defective parts involves standard repair techniques. The following precautions, however, should be observed.

2. CHASSIS REPAIR.

Whenever maintenance is performed upon chassis cabling in the 618T-( ), check cabling after maintenance to assure that cable is still wired correctly. This may be done by performing a continuity check. A chassis cabling continuity chart is given in the assembly section of this manual.

3. PRINTED CIRCUIT BOARD REPAIR.

Parts mounted on printed circuit boards are bonded to the boards to protect them from damage due to humidity and moisture. This bonding, or postcoating, also protects the parts against excessive vibration while the equipment is in service. The following procedure gives instructions for postcoating a circuit board after a part has been removed, installed, or replaced.

A. Remove the part from the printed circuit board by melting the postcoating with a hot soldering iron; then unsolder the part, and lift it off the board with a pair of long-nosed pliers.

CAUTION: DO NOT USE SOLDERING IRONS RATED ABOVE 40 WATTS ON BOARDS BEARING TRANSISTORS, DIODES, CERAFIL CAPACITORS, OR OTHER HEAT-SENSITIVE COMPONENTS. ALSO, BE CAREFUL WHEN REMOVING COMPONENTS FROM PRINTED CIRCUIT BOARDS NOT TO DAMAGE THE CIRCUITRY ON THE BOARDS.

B. If necessary, remove excess solder from the joint with the soldering iron.

C. Insert new wire or component into correct tubelet, and clinch wire over tubelet.

D. Apply solder and soldering iron to joint, melting solder and heating joint at the same time. Do not keep iron on joint longer than necessary to complete solder flow throughout joint.

CAUTION: USE SOLDER WITH RESIN-CORE FLUX. ANY RESIN FLUX SOLDER APPROVED UNDER QQ-S-571 MAY BE USED. DO NOT USE SOLDER THAT HAS A CORE OF HYDRAZINE, ACID, OR OTHER UNAPPROVED FLUX.

E. Clean joint with a stiff-bristle brush and a small amount of organic solvent, such as trichloroethylene, toluol, or proprietary solvents such as Freon TMC. Remove excess solvent and dissolved flux with absorbent material. Use solvent sparingly since the postcoating may also be dissolved. Apply a small amount of solvent to area of solder joint only.

F. Obtain a 1-ounce bottle of Dennis 1169A liquid and a 2-ounce bottle of Dennis 1169B liquid (Collins part number 821-0166-00). Mix these two liquids together by pouring the contents of the small bottle into the larger bottle. Replace lid and mix by shaking. Small amounts of coating material may be used by measuring equal portions of 1169A and 1169B into a paper cup. Use a separate measuring spoon for each item. Mix thoroughly with a stirring stick.

G. Apply the Dennis 1169 mixture to the newly soldered joint (or joints), covering all areas where the original postcoating was damaged and any new components that were added. Use a soft-bristle brush to apply the coating. The brush may be cleaned in an organic solvent before the coating hardens.

H. Allow the newly coated boards to dry to a tack-free condition (approximately 2 hours) before reassembling the module. The final cure will take about 7 days at room temperature or one hour at 60°C. The equipment may be operated during the curing period.

CHAPTER 7

ASSEMBLY

Note: All paragraph references in this chapter are to paragraphs within this chapter unless otherwise specified. All figure references in this chapter are to figures in this chapter except references to figures in the 100 series. Figures in the 100 series may be found in chapter 3.

CHAPTER 7

ASSEMBLY

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List of Illustrations

List of Tables

1. GENERAL.

Components that were removed during disassembly should be repaired or replaced as required and reassembled according to the following procedures.

2. GENERAL TECHNIQUES AND PRECAUTIONS IN ASSEMBLY OF AIRBORNE SSB TRANSCEIVER 618T-( ).

A. All wires should be secured to terminals mechanically before soldering. All soldering, except that on printed circuit boards, is to be per MIL-S-6872, using resin-core solder per QQ-S-571, composition SN60 (FSN 3432-269-9610).

B. All screws and fasteners not secured with a locking device should be secured with blue varnish, Collins part number 005-0133-00.

C. When installing a transistor or diode, use long-nosed pliers to grasp the lead to which heat is being applied between the solder joint and the component. This will bleed off some of the heat that conducts into the component from the soldering iron. Make sure that wires being soldered to the component are pretinned properly so the connection can be made quickly. Excessive heat will damage a transistor or diode permanently.

D. Replaced electrical leads should be of the same wire size and color coding as those installed at the factory.

E. Tie electrical cabling on both sides of breakouts and at approximately one-half-inch intervals with tape. Secure all ties with blue varnish.

3. SPECIFIC ASSEMBLY TECHNIQUES.

A. Replacement of Crystal in R-F Oscillator Module.

(1) Position crystal (5) as shown in figure 108.

(2) Solder blue crystal lead (8) to C1 (9). Make connection quickly to avoid overheating crystal.

(3) Solder green crystal lead (7) to circuit board (2). Make connection quickly to avoid overheating crystal.

(4) Repack grease (6), Collins part number 005-0201-00, around base of crystal.

(5) Place oven (3) over crystal and C1.

(6) Replace two screws (4) on opposite sides of oven.

(7) Replace two screws (1) that fasten oven to circuit board.

(8) Replace oven and crystal oscillator assembly in foam.

(9) Replace wires extending from bottom of foam, and replace foam plug at bottom.

(10) Replace wires extending from top of foam, and replace foam plug at top.

(11) Replace foam in module chassis.

(12) Replace two hold-down screws.

(13) Replace cover plate.

(14) Replace dust cover.

(15) Replace module in 618T-( ) chassis.

B. Assembly of Power Amplifier Module.

(1) Replace gear plate by sliding band-switch shaft through the switch. Be sure that lower strap is inserted under the securing screw washers when gear plate is pushed into place.

NOTE: If shaft is not chamfered on end, chamfer slightly before replacing.

(2) Tighten screw securing lower strap to roller coil assembly.

(3) Replace screw and washer holding the large silver-plated coil to roller coil assembly. Use hole nearest gear plate.

(4) Replace two nylon screws and washers holding the roller coil assembly to bracket near tubes. Damage will result if screws are secured too tightly.

CAUTION: BEND SCREEN BYPASS CAPACITOR DOWN TO COVER SCREWS JUST REPLACED. IF CAPACITOR IS NOT POSITIONED CORRECTLY, PLATE STRAP WILL ARC TO CAPACITOR.

(5) Replace square plate on rear of module using eight screws.

(6) Replace top cover plate by laying it in position, pushing it toward rear of module, and tightening 17 screws.

(7) Replace seven screws (S) on gear plate. Refer to figure 107.

C. Replacement of Turrets in R-F Translator Module.

(1) Insert turrets from bottom of module so that all color-coded dots on turrets are in line at top of module.

NOTE: Each turret is marked with two color-code dots: one white and one a standard color-code color. The white dot always is nearest the gear plate. Turrets are color coded so that turret S1 is nearest gear plate. Therefore, color-code dots should be (from the gear plate): white, brown, white, red, white, orange, etc. When inserting a turret, orient it so that spring contacts which project from the faces of the turret will not fall into the shaft holes when turret is being positioned.

(2) When all seven turrets are in place, replace turret shaft through gear that turns shaft. Before tightening shaft clamp, refer to paragraph 7.B. in this chapter for turret alignment procedure.

(3) Refer to figure 101. Replace two aligning rods (13) by inserting through gear plate. Secure rods with two screws through rear plate.

D. Assembly of Autopositioner Submodule.

(1) Replacement of Solenoid.

(a) Replace solenoid (101), Collins part number 546-6857-003, on bracket (93) using two screws (104) and post (100). Be sure post (100) holding reversing switch lever (84) is in correct hole. Align solenoid (101) so that its shaft hole is lined up with shaft hole in bracket (93) before tightening screws.

(b) Solder insulated jumper from solenoid relay terminal 6 to solenoid terminal 2. See figure 105(B).

(c) Replace retaining ring (109) on shaft (119).

(d) Replace pawl plate (103) in solenoid (101) using two screws (102).

NOTE: Be sure these two screws (102) are the same as those removed during disassembly. If screws are lost, they must be replaced with screws having the same color code.

(e) Replace hub (120) and notched wheel (121) on shaft (119). Replace pin (122) through hole in nut and shaft.

(f) Replace small fiber actuator (110) between pawl plate (103) and solenoid relay contacts. See figure 105(B) for proper placement of actuator.

(g) Perform steps (a) through (c) of paragraph 3.D.(2).

(2) Assembly of Clutch Assembly.

(a) Replace clutch gear (123) and clutch disc (124).

CAUTION: DO NOT LUBRICATE OR CLEAN CLUTCH SURFACES ON 121, 123, OR 124. WIPE ONLY WITH DRY, CLEAN, LINTLESS CLOTH. DO NOT TOUCH CLUTCH SURFACES WITH FINGERS.

(b) Replace spring washer (125) with concave side against disc (124). Replace washer (126) and nut (127).

(c) Tighten nut (127) until 30 to 40 in. oz of torque is needed to slip clutch gear (123). This torque can be measured with a Waters Torque Watch, Model 651C3, or equivalent. Attach torque watch to end of shaft (119). Hold gear (123) stationary and rotate watch. Adjust nut (127) until proper torque is indicated on watch. Bend two tabs on washer (126) against flats on nut (127) when clutch is torqued properly.

(d) Perform steps (a) through (j) of paragraph 3.D.(4).

(3) Replacement of Switch Wafers.

Because of problems encountered in replacing individual resistors on the switch wafers, the entire switch wafer assembly, which includes resistors on the wafer, should be replaced if one or more of the resistors is defective. Collins part numbers for all switch wafer assemblies are given in table 501. Refer to figure 106 for identification of these wafers and connecting wiring between wafers.

(4) Replacement of 10-Kc and 100-Kc Switches.

(a) Position switch wafers on shaft so that they are oriented as shown in figure 105(D).

(b) Resolder any cable leads that were unsoldered during disassembly. Use figure 106(A) as a guide when replacing wires which connect switch wafers.

(c) Replace all metal spacers (61, 62) between switch wafers. Fasten wafers together and to bracket (93) with two screws (55) and washers (56).

TABLE 501
AUTOPOSITIONER SWITCH ASSEMBLIES

SWITCH WAFER	COLLINS PART NUMBER
S1	269-2190-00
S2	269-2190-00
S3	546-6865-003
S4	546-6862-002
S5	546-6861-002
S6	546-6860-002

(d) Place the six solenoid leads, which were unsoldered earlier, through hole in bracket (93). Resolder these six wires to solenoid (101) and solenoid relay terminals (112). See figure 105(B). Retie these wires.

(e) Replace reversing switch (87) using two screws (88). Be sure switch leaf is in slot in reversing switch lever (84).

(f) Replace cable clamp (89) using screw (90) and washer (91).

(g) Place switch assembly in Autopositioner chassis. Be sure to place all shim washers (if any), which were removed earlier, over shaft before inserting shaft through gear plate. Be sure clutch gear (123) meshes with gear (154).

(h) Replace cable clamp (21) using screw (26).

(i) Replace resistor (14) on gear plate using screw (15) and washers (16, 17, 19). Position resistor terminals so that they are parallel to long sides of gear plate.

(j) Perform steps (a) through (j) of paragraph 3.D.(5).

(5) Replacement of 1-Kc Switches.

(a) Resolder any cable wires or wires connecting wafers that were removed during disassembly. Use figure 106(B) as a guide.

(b) Replace all ceramic spacers (36) and fiber washers (37) between switch wafers. Fasten wafers together and to mounting plate with two screws (35).

(c) Rotate gear (1) or (5) by hand to position cam (32) so that cam follower (98) is as near camshaft (31) as possible.

(d) Place mounting plate (163) in position at ends of mounting posts (135). When sliding camshaft (31) through 1-kc switch wafers, be sure both wafers are aligned as shown in figure 105(C). Tighten mounting plate using four screws (136).

(e) Replace motor (148) and motor bracket (149) on mounting plate using two screws (151) and two washers (150).

(f) Replace relay (140) on mounting plate using two nuts (142) and two washers (141).

(g) Replace two cable clamps (157) using two screws (139).

(h) Replace vfo coupler (130) on output shaft (119) by tightening two setscrews (134).

(i) Replace output shaft gear (9) using setscrew (11) in clamp (10). Be sure this gear has maximum face-width engagement with gear (57).

(j) Replace spring (138) by hooking bar (137) in slots on mounting posts (135). Hook free end of spring first.

(k) Refer to paragraph 7.A. for Autopositioner alignment, and check procedure before replacing submodule in r-f translator module.

(6) Replacement of Reversing Switch.

(a) Resolder the six wires connected to the switch (87), Collins part number 266-0096-00. Refer to figure 105(A).

NOTE: Be sure switch leads are positioned so there is clearance for switch assembly to rotate.

(b) Replace switch in bracket (93). The brass-plate side should be against the bracket. Be sure switch leaf is in slot in reversing switch lever (84).

NOTE: On some units, a spring clip is mounted with a finger between the reversing switch and the bracket.

(c) Replace two screws (88) through switch. When the spring clip is used, tighten the screws so that the switch leaf is the same distance from the center of the hole in the bracket in both positions.

(d) Replace cable clamp (89) using screws (90) and washer (91).

(e) Replace cable clamp (21) using screw (26).

(f) Replace spring (138) by hooking bar (137) in slots on mounting posts (135). Hook free end of spring in place first.

NOTE: Check again to see that switch leads are positioned so that there is clearance for switch assembly to rotate.

E. Replacement of Autopositioner and VFO in R-F Translator Module.

NOTE: Be sure Autopositioner is positioned to 500 kc before installing in r-f translator module.

(1) Refer to figures 101, 102, and 103. Carefully maneuver Autopositioner into place under gear plate. Place 25-pin connector (8) through 28-position switch to its position at bottom of module. Be careful not to damage switch wafers when placing connector through switch.

(2) Replace four screws (11) holding Autopositioner to gear plate. Leave screws one-half turn loose.

(3) Position the two slug racks (12) at equal height above the chassis.

CAUTION: MAKE CERTAIN THAT THE TWO SLUG RACKS ARE EQUAL IN HEIGHT ABOVE THE CHASSIS. THE SLUG RACK HAS NO STOPS. THEREFORE, IF RACKS ARE NOT POSITIONED CORRECTLY AT 500 KC, AUTOPOSITIONER COULD RUN RACK BEYOND ITS DESIGN RANGE, STRETCHING AND RUINING THE TAPES.

With slug racks in this position, position clamp on slug rack gear so that it is facing top of module.

(4) Replace idler gear (G9) that couples Autopositioner gears to slug rack gear.

(5) Position Autopositioner in oversize mounting holes to remove as much backlash as possible in idler gear drive. Tighten four Autopositioner mounting screws (11).

(6) Fasten 25-pin connector (8) to bottom of r-f translator chassis with two screws (10).

(7) Replace 3/8-inch flatted shaft (7) above 25-pin connector by placing it through gear that turns shaft.

(8) Tighten clamp (9) that holds shaft.

(9) Position vfo shaft midway between end stops by positioning stop mechanism as shown in figure 504.

(10) Place vfo in its position under Autopositioner. Run three vfo leads (6) through holes in r-f translator chassis, and solder to connectors P6 and J32-31 and internal connections in module.

(11) Replace four tubes (5) adjacent to vfo and Autopositioner.

(12) Rotate rear brackets (3) on vfo so that they can be fastened to rear plate.

(13) Replace four screws (2) fastening vfo brackets to rear plate and r-f translator chassis.

(14) Tighten two setscrews in coupler on Autopositioner output shaft. Refer to paragraph 7.C., this chapter for slug rack alignment. Refer to paragraph 6P, chapter 8 for vfo alignment.

F. Replacement of Modules and Module Covers.

(1) Replace modules on chassis by carefully engaging aligning pins and connectors on bottom of module and tightening redheaded captive hold-down screws.

CAUTION: BE CERTAIN THAT ALL CONNECTORS ARE SEATED PROPERLY BEFORE TIGHTENING HOLD-DOWN SCREWS. CONNECTORS MAY BE DAMAGED IF CONNECTORS ARE NOT MATED PROPERLY. BE CERTAIN THAT GASKETS ON J25, J26, AND J29 (SEE FIGURE 502) ARE IN PLACE BEFORE MODULES ARE FASTENED ON CHASSIS.

(2) Replace module covers by placing them over modules and pushing toward chassis. Covers are held in place without screws.

G. Replacement of Front Panel, Front Panel Cover, and Side Covers.

(1) Replace front panel by tightening four screws at each corner of panel.

(2) Replace front panel cover by placing cover over front panel and turning two Dzus fasteners on cover.

(3) Replace side covers by placing covers in slots at front of chassis and tightening four screws at rear of chassis.

4. CHASSIS CABLING CHECK.

Table 503 is a continuity check which may be performed to establish the correctness of chassis cabling and wiring. The test should be performed with no power applied to the 618T-( ). The response in all cases should be zero ohm except if noted otherwise in parentheses. Use a vom, such as a Triplett 630A. Table 502 gives chassis connector information. Refer to figures 501 and 502 for front panel and chassis component identification.

5. VISUAL CHECKS.

After replacing all modules in chassis, check that each module is secure and seated properly. Inspect each module for loose parts, broken wires and hardware, and loose plugs and connectors.

6. LUBRICATION.

The following lubrication procedure should be followed to lubricate the 618T-( ) after it has been reassembled. Table 504 lists lubricants to be used.

TABLE 502. CHASSIS CONNECTORS

NO.	PURPOSE	MATES WITH
J1	PHONE	Headphone jack
J2	MIC	Microphone jack
J3	AUX RCVR ANT.	Auxiliary receive antenna jack
J4	ANT.	Antenna jack
J5	RCVR IF. OUT	Jumper
J6	RCVR IF. IN	Jumper
J7	500 KC STD	Jumper
J8	500 KC REF	Jumper
J9	Low-voltage power supply connector	A5P1
J10-A1	100 KC OUT	A2P2-A1
J10-A2	500 KC (LOW) OUT	A2P2-A2
J10-A3	500 KC (HI) OUT	A2P2-A3
J11	R-f oscillator connector	A2P1
J12	Kc stabilizer connector	A4P1

TABLE 502. CHASSIS CONNECTORS (Cont)

NO.	PURPOSE	MATES WITH
J12-A1	VFO IN/VFO DC CONTROL OUT	A4P1-A1
J12-A2	10 KC PRF IN	A4P1-A2
J12-A3	1 KC SPECTRUM IN	A4P1-A3
J14	Mc stabilizer connector	A10P1
J14-A1	17.5 MC IN/HF OSC. DC CONTROL OUT	A10P1-A1
J14-A2	HF OSC. IN/17.5 MC OSC DC CONTROL OUT	A10P1-A2
J14-A3	500 KC (LOW) IN	A10P1-A3
J15	Frequency divider connector	A1P1
J15-A1	1 KC SPECTRUM OUT	A1P1-A1
J15-A2	100 KC IN	A1P1-A2
J15-A3	10 KC PRF OUT	A1P1-A3
J16	500 KC RECEIVE IN	A9P1
J17	AM/audio amplifier connector	A9P2
J18	500 KC RECEIVE IN	A3P1
J19	500 KC TRANSMIT OUT	A3P2
J20	500 KC REFERENCE IN	A3P3
J21	I-f translator connector	A3P4
J22	Electronic control amplifier connector	A6P1
J23	HV DC OUT	A7P2 or A8P2 or A13P2
J24	High-voltage power supply connector	A7P1 or A8P1 or A13P1
J25	RF OUT	A11P5
J26	FEEDBACK OUT	A11P1
J27	HV DC IN	A11P3
J28	Power amplifier connector	A11P4
J29	GRID INPUT	A11P2
J30	FEEDBACK IN	A12P3
J31	RF OUT	A12P2
J32	R-f translator connector	A12P9
J33	R-f translator connector (Autopositioner)	A12A1P1
J34	500 KC TRANSMIT IN	A12P1

TABLE 502. CHASSIS CONNECTORS (Cont)

NO.	PURPOSE	MATES WITH
J35	VFO OUT/VFO DC CONTROL IN	A12P6
J36	17.5 MC OSC OUT/HF OSC DC CONTROL IN	A12P7
J37	RECEIVE ANT	A12P5
J38	500 KC RECEIVE OUT	A12P4
J39	HF OSC OUT/17.5 MC OSC DC CONTROL IN	A12P8
P40	60-pin rear connector (male)	Cable connector (female)
P41	Chassis ground	Ground cable

TABLE 503. 618T-( ) CHASSIS CONTINUITY CHECK

+27.5 V D-C BUS	115 V, 400 CPS BUS	+18 V D-C BUS	+130 V D-C BUS	KEY LINE
E25	J9-8	J9-1	E7	J2-2
J9-4	J24-33	J9-2	E8	J17-22
J17-21	J28-19	J11-5	J9-14	K4-7
J21-14	K1-6	J11-9	J32-18	P40-55
J24-17	K3-12	J12-2*	TB1-2	
J28-12	K7-2	J12-8		**KEY LINE***
J32-17	P40-11	J14-1		J21-25
J33-14	T1-4	J14-2*		J24-13
K1-4		J15-2		J32-16
K3-2		J17-5*		K2-1
K4-2		J17-11**		K3-1
K5-2		J21-5*		K4-8
K6-7		J21-11**		K5-1
P40-56		J32-28		
TB1-3		K2-4**		
		K2-5		
		K4-4		
		K4-5*		
		K10-8		

TABLE 503. 618T-( ) CHASSIS CONTINUITY CHECK (Cont)

FROM	TO	FROM	TO
J1-1	K6-4, P40-58	J10-A1	J15-A2
2	J17-3, P40-57, R9B "C", R10B "C"	A2	J14-A3
J2-1	K2-7, P40-54	A3	J7
2	Key line	J11-1	J9-5, K1-7
3	Chassis	2	NC
J3	J37, K5-7	3	Chassis
J4	K5-4	4	NC
J5	J38	5	+18 v d-c bus
J6	J16, J18	6	NC
J7	J10-A3	7	Chassis
J8	J20	8	NC
J9-1	+18 v d-c bus	9	+18 v d-c bus
2	+18 v d-c bus	J12-1	J33-19
3	Chassis	2	J14-2, K10-3
4	+27.5 v d-c bus	3	Chassis
5	J11-1, K1-7	4	J33-4
6	NC***	5	J33-20
7	Chassis	6	E10
8	115 v, 400 cps bus	7	J32-31
9	NC	8	+18 v d-c bus
10	C7-3, J17-6, J22-3, L2-1	9	E9, J33-18
11	NC	10	J33-3
12	NC	A1	J35
13	NC	A2	J15-A3
14	E7, E8, J32-18, TB1-2	A3	J15-A1
15	NC		

TABLE 503. 618T-( ) CHASSIS CONTINUITY CHECK (Cont)

FROM	TO
J14-1	+18 v d-c bus
2	J12-2, K10-3
3	NC
4	NC
5	Chassis
6	NC
7	NC
8	NC
9	NC
10	NC
A1	J36
A2	J39
A3	J10-A2
J15-1	Chassis
2	+18 v d-c bus
3	NC
4	NC
5	NC
6	J17-25, S1-10-1/2
7	NC
8	NC
9	NC
10	NC
A1	J12-A3
A2	J10-A1

FROM	TO
J15-A3	J12-A2
J16	J6, J18
J17-1	Chassis
2	K3-4
3	J1-2, P40-57, R9B "C", R10B "C"
4	K2-6
5	J21-5, K4-5
6	C7-3, J9-10, J22-3, L2-1
7	J21-7
8	J32-15
9	P40-42
10	J21-10
11	J21-11, K2-4
12	P40-60
13	K2-11
14	J21-9, K2-10
15	P40-53
16	P40-37
17	NC
18	NC
19	NC
20	J21-4, S1-7
21	+27.5 v d-c bus
22	Key line

TABLE 503. 618T-( ) CHASSIS CONTINUITY CHECK(Cont)

FROM	TO
J17-23	E19, J28-18, P40-10
24	P40-31
25	J15-6, S1-10-1/2
J18	J6, J16
J19	J34
J20	J8
J21-1	Chassis
2	NC
3	NC
4	J17-20, S1-7
5	J17-5, K4-5
6	E18, P40-25
7	J17-7
8	J28-22
9	J17-14, K2-10
10	J17-10
11	J17-11, K2-4
12	J28-23
13	P40-24
14	+27.5 v d-c bus
15	NC
16	NC
17	J24-14
18	J28-21
19	E17, J24-15, K2-12, TB1-4

FROM	TO
J21-20	J28-16
21	NC
22	NC
23	NC
24	NC
25	Key line
J22-1	Chassis
2	J28-14
3	C7-3, J9-10, J17-6, L2-1
4	Chassis
5	Shield (J22-9)
6	J28-15
7	K3-10
8	NC
9	J29-25
J23	J27
J24-1	J28-9, J32-9
2	NC
3	NC
4	Chassis
5	NC
6	Chassis
7	P41
8	P41
9	P41

TABLE 503. 618T-( ) CHASSIS CONTINUITY CHECK (Cont)

FROM	TO	FROM	TO
J24-10	P41	J24-35	TB1-1
11	P41	36	J32-19
12	P41	37	J28-17
13	Key line*	J25	K5-3
14	J21-17	J26	J30
15	E17, J21-19, K2-12, TB1-4	J27	J23
16	J28-10	J28-1	J32-1
17	+27.5 v d-c bus	2	J32-2
18	K2-2, K7-7	3	J32-3
19	P40-7	4	J32-4
20	J32-10	5	J32-5
21	J32-12	6	J32-6
22	J32-11	7	J32-7
23	J32-13	8	J32-8
24	NC	9	J24-1, J32-9
25	P40-17	10	J24-16
26	P40-1	11	J32-27, K4-1
27	P40-13	12	+27.5 v d-c bus
28	P40-14	13	Shield (J28-25)
29	P40-2	14	J22-2
30	P40-3	15	J22-6
31	P40-15	16	J21-20
32	K1-8, K10-4, L2-2	17	J24-37
33	115 v, 400 cps bus	18	E19, J17-23, P40-10
34	NC	19	115 v, 400 cps bus

TABLE 503. 618T-( ) CHASSIS CONTINUITY CHECK (Cont)

FROM	TO
J28-20	NC
21	J21-18
22	J21-8
23	J21-12
24	Chassis
25	J22-9
J29	J31
J30	J26
J31	J29
J32-1	J28-1
2	J28-2
3	J28-3
4	J28-4
5	J28-5
6	J28-6
7	J28-7
8	J28-8
9	J24-1, J28-9
10	J24-20
11	J24-22
12	J24-21
13	J24-23
14	P40-30
15	J17-8
16	Key line*

FROM	TO
J32-17	+27.5 v d-c bus
18	E7, E8, J9-14, TB1-2
19	J24-36
20	P40-36
21	P40-35
22	P40-34
23	P40-33
24	P40-32
25	NC
26	Chassis
27	J28-11, K4-1
28	+18 v d-c bus
29	J33-21
30	NC
31	J12-7
32	NC
33	NC
34	NC
35	NC
36	NC
37	NC
J33-1	Chassis
2	NC
3	J12-10
4	J12-4

TABLE 503. 618T-( ) CHASSIS CONTINUITY CHECK (Cont)

FROM	TO	FROM	TO
J33-5	NC	J38	J5
6	P40-38	J39	J14-A2
7	P40-39	P40-1	J24-26
8	P40-40	2	J24-29
9	P40-41	3	J24-30
10	P40-49	4	K1-2, K1-3, P40-16
11	P40-50	5	K7-1
12	P40-51	6	NC
13	P40-52	7	J24-19
14	+27.5 v d-c bus	8	NC
15	NC	9	K3-6
16	NC	10	E19, J17-23, J28-18
17	NC	11	115 v, 400 cps bus
18	E9, J12-9	12	E22, K1-5
19	J12-1	13	J24-27
20	J12-5	14	J24-28
21	J32-29	15	J24-31
22	P40-45	16	K1-2, K1-3, P40-4
23	P40-46	17	J24-25
24	P40-47	18	Chassis
25	P40-48	19	NC
J34	J19	20	NC
J35	J12-A1	21	NC
J36	J14-A1	22	NC
J37	J3, K5-7	23	NC

TABLE 503. 618T-( ) CHASSIS CONTINUITY CHECK (Cont)

FROM	TO	FROM	TO
P40-24	J21-13	P40-49	J33-10
25	E18, J21-6	50	J33-11
26	K4-9	51	J33-12
27	Chassis	52	J33-13
28	NC	53	J17-15
29	NC	54	J2-1, K2-7
30	J32-14	55	Key line
31	J17-24	56	+27.5 v d-c bus
32	J32-24	57	J1-2, J17-3, R9B "C", R10B "C"
33	J32-23	58	J1-1, K6-4
34	J32-22	59	K9-4
35	J32-21	60	J17-12
36	J32-20	P41	J24-7 through 12
37	J17-16	K1-1	K9-7
38	J33-6	2	K1-3, P40-4, P40-16
39	J33-7	3	K1-2, P40-4, P40-16
40	J33-8	4	+27.5 v d-c bus
41	J33-9	5	E22, P40-12
42	J17-9	6	115 v, 400 cps bus
43	NC	7	J9-5, J11-1
44	NC	8	J24-32, K10-4 L2-2
45	J33-22	K2-1	Key line*
46	J33-23	2	J24-18, K7-7
47	J33-24	3	Chassis
48	J33-25	4	J17-11, J21-11

TABLE 503. 618T-( ) CHASSIS CONTINUITY CHECK (Cont)

FROM	TO
K2-5	+18 v d-c bus
6	J17-4
7	J2-1, P40-54
8	NC
9	Chassis (thru 5.6K)
10	J17-14, J21-9
11	J17-13
12	E17, J21-19, J24-15, TB1-4
13	K6-1
14	NC
K3-1	Key line*
2	+27.5 v d-c bus
3	R9A "in"
4	J17-2
5	R10A "in"
6	P40-9
7	Chassis
8	NC
9	TB1-10
10	J22-7
11	NC
12	115 v, 400 cps bus
13	B1-T1
14	T1-3
K4-1	J28-11, J32-27

FROM	TO
K4-2	+27.5 v d-c bus
3	NC
4	+18 v d-c bus
5	J17-5, J21-5
6	NC
7	Key line
8	Key line*
9	P40-26
10	Chassis
11	K8-1
12	NC
13	NC
14	NC
K5-1	Key line*
2	+27.5 v d-c bus
3	J25
4	J4
5	S2
6	Chassis
7	J3, J37
8	S2
K6-1	K2-13
2	E1
3	R10A "out"
4	J1-1, P40-58

TABLE 503. 618T-( ) CHASSIS CONTINUITY CHECK (Cont)

FROM	TO	FROM	TO
K6-5	C2, K6-6	K9-6	NC
6	C2, K6-5	7	K1-1
7	+27.5 v d-c bus	8	NC
8	C5 (+)	K10-1	TB2-4
K7-1	P40-5	2	NC
2	115 v, 400 cps bus	3	J12-2. J14-2
3	Chassis	4	J24-32, K1-8, L2-2
4	NC	5	K8-7, TB2-3
5	NC	6	TB2-9
6	NC	7	TB2-1
7	J14-28, K2-2	8	+18 v d-c bus
8	NC	TB-1	J24-35
K8-1	K4-11	2	E7, E8, J9-14, J32-18
2	NC	3	+27.5 v d-c bus
3	NC	4	E17, J21-9, J24-15, K2-12
4	Chassis	5	L3-2
5	E11	6	S1-3
6	TB2-2	7	S1-4
7	K10-5, TB2-3	8	S1-5
8	NC	9	S1-12
K9-1	Chassis	10	K3-9
2	NC	TB2-1	K10-7
3	NC	2	K8-6
4	P40-59	3	K8-7, K10-5
5	E21, E23	4	K10-1

TABLE 503. 618T-( ) CHASSIS CONTINUITY CHECK (Cont)

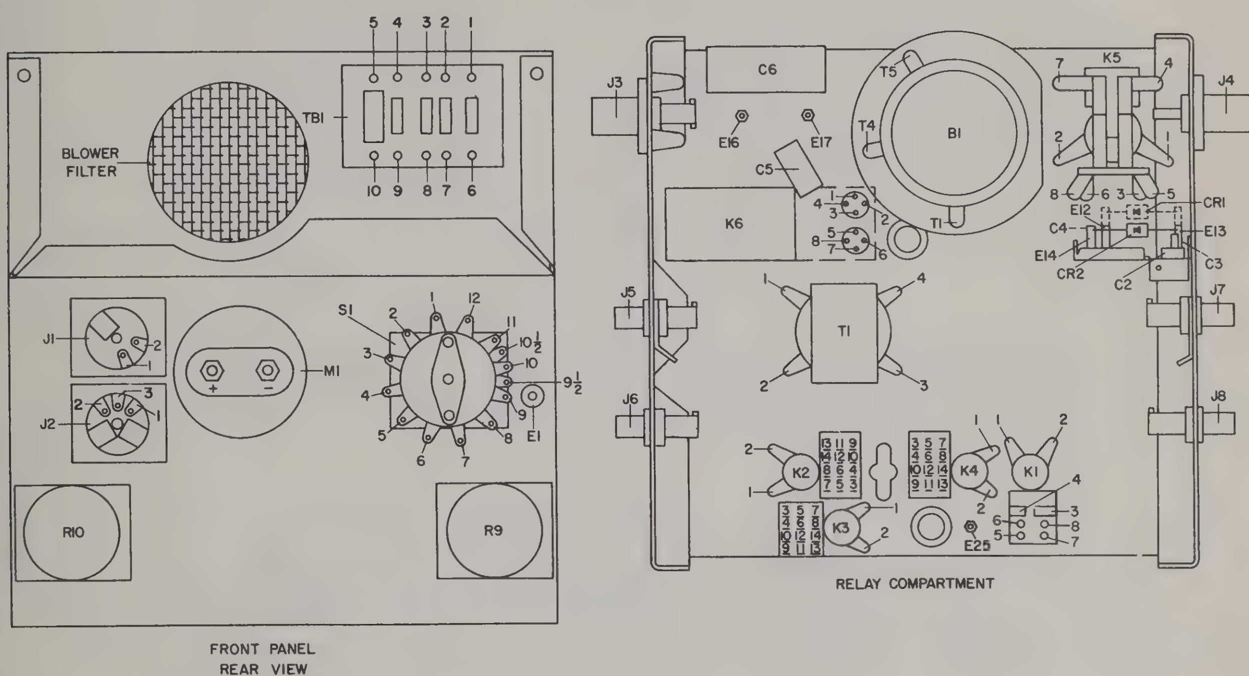
FROM	TO
TB2-5	--
6	--
7	--
8	--
9	K10-6
10.	--
M1 (+)	S1-2
(-)	S1-8
S1-1	NC
2	M1 (+)
3	TB1-6
4	TB1-7
5	TB1-8
6	Chassis
7	J17-20, J21-4, S1-9-1/2 (thru 8.2K)
8	M1 (-)
9	Chassis
9-1/2	S1-07 (thru 8.2K)
10	Chassis
10-1/2	J15-6, J17-25
11	Chassis
12	TB1-9
T1-1	Chassis
2	L3-1
3	K3-14
4	115 v, 400 cps bus

FROM	TO
E1	K6-2
2	NU****
3	NU
4	NU
5	NU
6	NU
7	E8, J9-14, J32-18, TB1-2
8	E7, J9-14, J32-18, TB1-2
9	J12-9, J33-18
10	J12-6
11	K8-5
12	--
13	--
14	--
15	Chassis
16	Chassis
17	J21-19, J24-15, K2-12, TB1-4
18	J21-6
19	J17-23, J28-18, P40-10
20	--
21	E23, K9-5
22	K1-5, P40-12
23	E21, K9-5
24	Chassis
25	+27.5 v d-c bus
26	K4-11
27	NU

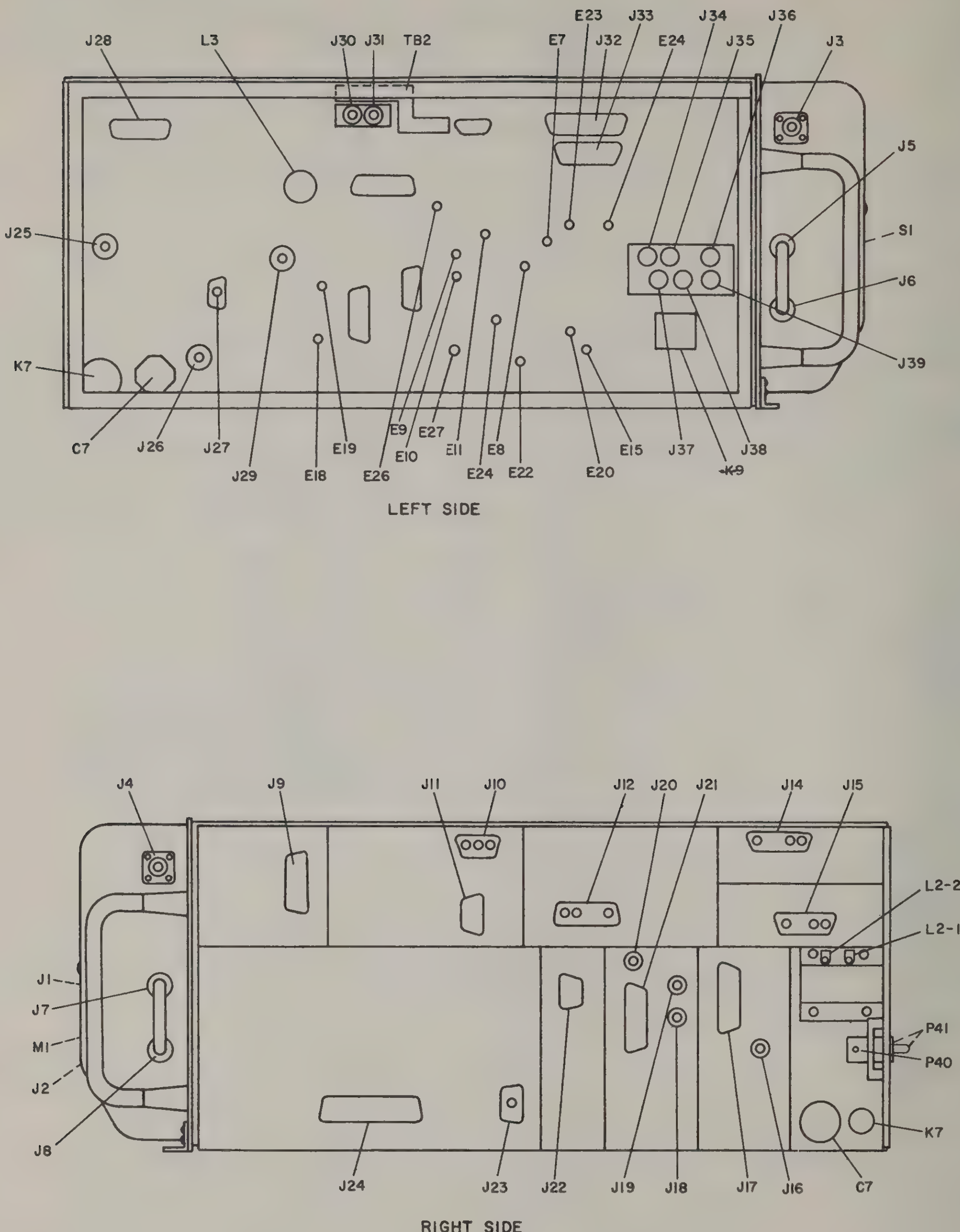
* Interrupted during recycle.
** Interrupted during transmit.
*** NC - No connection.
**** NU - Not used.

TABLE 504. LUBRICANTS

LUBRICANT	TYPE	MILITARY SPECIFICATION
Oil	Esso Univis P-38	MIL-L-6084
Grease	Beacon 325	MIL-G-3278



Airborne SSB Transceiver 618T-( ), Front Panel (Rear View) and Relay Compartment
Figure 501



Airborne SSB Transceiver 618T-( ), Left and Right Side Views (Modules Removed)
Figure 502

A. Autopositioner.

(1) Refer to figure 104. Lubricate gears (152) and (154) with grease. Apply grease sparingly and only on gear teeth.

(2) Apply grease very sparingly on all switches. Lubricate contact surfaces of clips and rotors.

(3) Apply grease sparingly to inside of gear (123).

NOTE: Do not get grease on clutch surfaces on this gear.

(4) Lubricate all bearings, except gear (123), with oil.

B. R-F Translator.

Lubricate all bearings with oil.

C. Power Amplifier.

Lubricate all bearings on gear plate with oil.

7. ALIGNMENT AND ADJUSTMENT PROCEDURES.

A. Autopositioner Alignment and Check.

The following procedure is to be performed with Autopositioner submodule fastened to r-f translator module extender which is supplied with Maintenance Kit 678Y-1. Use special attachment in this kit to fasten Autopositioner to extender. Set the 714E-( ) mode selector switch to OFF.

(1) Check to see that actuating leaf or reversing switch is visible in both operating positions through hole in switch mounting bracket.

(2) Refer to figure 105B. Check that gap between contacts 3 and 4 on solenoid relay (with pawl in notch) is at least 0.015 inch.

(3) Check that contacts 3 and 4 on solenoid relay are closed when pawl engages notched wheel by at least 0.005 inch.

(4) Check that gap between contacts 5 and 6 on solenoid relay (with back of pawl against solenoid housing) is at least 0.015 inch.

(5) Rotate the 1-kc cam by hand until hole in cam is adjacent to cam follower. Set frequency to 0.000 mc, any megacycle band. Momentarily switch mode selector switch on control unit to USB, then back to OFF. While doing this, observe the direction of rotation of the camshaft from the gear-plate side. When viewed from this side, the shaft must rotate counterclockwise.

CAUTION: CAM WILL BE DAMAGED IF IT ROTATES CLOCKWISE.

(6) Push the actuating leaf of reversing switch toward cam. Momentarily switch the 714E-( ) mode selector to USB, then back to OFF. Clutch gear should rotate clockwise as viewed from gear-plate side. With leaf in opposite position, clutch gear rotation should be in opposite direction. If directions of rotation are improper, rewire reversing switch as shown in figure 105(A).

(7) Attach calibrated disc and pointer supplied in Maintenance Kit 678Y-1 to Autopositioner output shaft. Check that disc rotates one position for each 1-kc change in frequency, 10 positions for each 10-kc change, and one revolution for each 100-kc change.

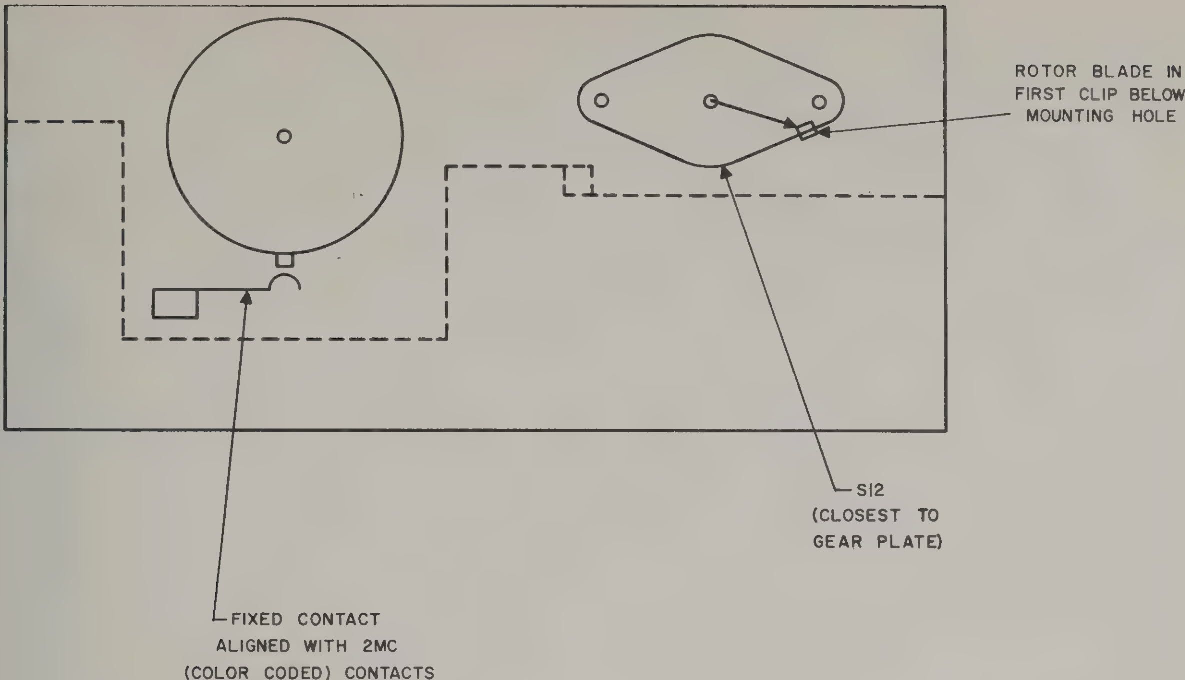
B. R-F Translator Turret and Switch Alignment.

(1) Refer to figure 503 With frequency selector positioned to 2.000 mc, adjust turret drive shaft so that 2-mc turret contacts (identified by color coding) are centered on fixed contacts. Tighten clamp screw.

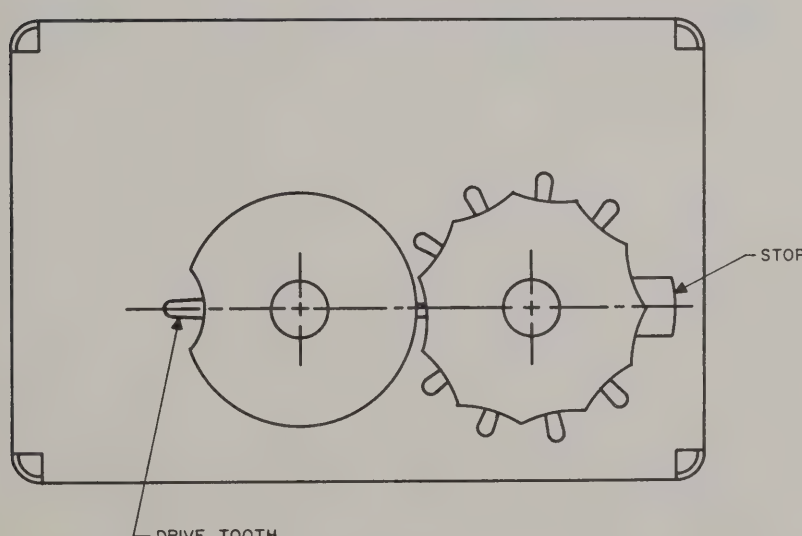
(2) Adjust band-switch shaft until clip is positioned as shown in figure 503. Tighten clamp screw.

(3) Recycle the Autopositioner to 2.000 mc and recheck the turret contacts and band-switch clip positions. Readjust if necessary.

(4) Early models of r-f translator modules have a 28-position switch in place of turrets. To align this switch, remove the module covers, place the r-f translator module on the module extender supplied with Maintenance Kit 678Y-1, and apply power to the 618T-( ). Set the frequency to 22.000 mc. View the band switch from the bottom of the module. (The switch will be on the right side when viewed from the bottom of the module.) Inspect the fifth switch wafer from the gear plate. The tooth on the rotor should be in the center of the 22-mc clip, which is the 8th clip clockwise from the left-hand mounting hole on the switch wafer. This clip can be identified by the fact that the wiring to the first seven clips goes to the left, and the wiring to the eighth to fourteenth clips goes to the right side as viewed from the bottom of the module. If the tooth on the rotor is not centered in the clip, loosen clamp on the gear mounted on the switch shaft, and rotate shaft until rotor tooth is centered in the switch clip. Reposition r-f translator to 22.000 mc, and again check to see that the rotor tooth is centered in the 22-mc clip position. Repeat this procedure if necessary.



Turret and Switch Alignment, R-F Translator Module
Figure 503



VFO in 500-Kc Position
Figure 504

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CHAPTER 8

TESTING

<u>Note</u>: All paragraph references in this chapter are to paragraphs within this chapter unless otherwise specified.

CHAPTER 8

TESTING

Table of Contents

List of Illustrations

List of Tables

1. GENERAL.

This chapter is divided into four main divisions. These divisions, and a brief description of what each division contains, are listed below.

A. Operational Check.

The operational check is a simple, go-no go check that is performed while the 618T-( ) is operating in its normal installation. It requires no test equipment except a microphone and headphones. If this check shows that the 618T-( ) is not operating properly, remove it to a test bench, and perform the unit performance check.

B. Unit Performance Check.

The unit performance check is a detailed "black-box" check that is performed at a test bench equipped with a variety of regular and special 618T-( ) test equipment. This check indicates if the 618T-( ) performance meets the standards of the equipment specifications. A data sheet is included with this check so that test data can be analyzed and definite trouble symptoms determined more quickly. If this check indicates that the 618T-( ) is not operating properly, refer to the unit trouble-shooting portion of the trouble-shooting section to isolate trouble within the unit to a particular module or group of modules.

The unit performance check may also be used as a preinstallation bench check for the 618T-( ).

C. Unit Adjustments.

The unit adjustments are adjustments that are affected by module replacement. This requires that these adjustments be performed on the unit level.

D. Module Checks and Adjustments.

The module checks and adjustments contain detailed procedures for checking and adjusting each of the individual 618T-( ) modules. The adjustments in these procedures are not affected by module replacement. If these adjustments cannot return the module to proper operating condition, refer to the module trouble-shooting portion of the trouble-shooting section to isolate trouble within a module to a particular stage or group of stages.

2. TEST EQUIPMENT.

A. Regular Test Equipment.

The following regular test equipment, or equivalent, is required to perform the checks and adjustments in this chapter (refer to chapter 1, paragraph 7 for complete listing of test equipment and equivalents).

(1) Triplett 630-NA voltohmmeter (or Multimeter TS-352).

(2) Hewlett-Packard 410B voltmeter with 455A probe "T" connector (or Multimeter ME-26B).

(3) Ballantine 310A voltmeter (or Voltmeter Meter ME-30).

(4) Boonton 91-C voltmeter (or Voltmeter, Electronic AN/URM-145).

(5) Fluke 801B voltmeter (or Voltmeter, Electronic AN/USM-98).

(6) Hewlett-Packard 606A signal generator with Measurements Corp. 80-ZH3 6-db attenuator (or R. F. Signal Generator Set AN/URM-25F).*

(7) Hewlett-Packard 200AB audio oscillator (or Audio Oscillator TS-382).

(8) Tektronix 541 oscilloscope with type K plug-in head (or Oscilloscope AN/USM-81).

(9) Hewlett-Packard 524D frequency counter with type 525A frequency converter (or Frequency Meter AN/USM-26A).

(10) Collins 51S-1 Communications Receiver.

(11) Bird 82C dummy r-f load (Dummy Load DA-25).

(12) Headphones.

(13) Microphone.

B. Special Test Equipment. Note: Refer to paragraph 1D, chapter 1 for the official nomenclature of these items of special test equipment.

The following special 618T-( ) test equipment is required to perform the checks and adjustments in this section.

(1) Test Harness 689P-1, Collins part number 547-3914-00.

(2) Maintenance Kit 678Y-1, Collins part number 547-3915-00.

(3) Function Test Set 678Z-1, Collins part number 548-8001-005.

This special test equipment is described in detail in appendix II.

C. Transistor Test Equipment.

Transistor damage from test equipment usually results because too much current or voltage is applied to the transistor elements. Observe the following precautions regarding test equipment when testing transistor circuits.

(1) If a transformerless power supply is used, connect an isolation transformer in the power line.

(2) Do not use battery-eliminator power supplies because the regulation of these devices is poor at the current values drawn by transistor circuits.

(3) Connect a ground wire from the chassis of the test equipment to the chassis of the equipment being tested before making any other connections.

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*If a signal generator with a 52-ohm output, such as the HP-606A, is used, connect a 52-ohm, 6-db attenuator in series with the generator output. If the signal generator has a low-impedance output, such as Measurements Corp. 65B, connect a 52-ohm load in series with the generator output. Such a load is furnished in Maintenance Kit 678Y-1.

(4) Use at least 20,000-ohm-per-volt meters or vacuum-tube voltmeters for making all measurements.

(5) Use test prods that are clean and sharp. It is good practice to cover all of the exposed prod, except about 1/8 inch on the end, with plastic tape or some other insulating material.

(6) Before using an ohmmeter to make transistor resistance measurements, check the ohmmeter on all scales by placing an external, low-resistance milliammeter in series with the ohmmeter leads. If the ohmmeter draws more than one milliampere on any range, do not use this range on circuits containing small transistors.

(7) When using an ohmmeter to make transistor resistance measurements, remember that these components are polarity and voltage conscious; therefore, be sure that the correct polarity is applied to the circuit by the ohmmeter.

3. OPERATIONAL CHECK.

A. Test Equipment.

A microphone and headphones are the only test equipment required to perform the operational check.

B. Equipment Setup.

The 618T-( ) should be operating in its normal installation while performing the operational check procedure.

C. Procedure.

(1) Connect the microphone and headphones to the MIC and PHONE jacks at the front of the 618T-( ).

(2) Apply power to the 618T-( ) by setting Control Unit 714E-( ) mode selector switch to USB, LSB, or AM.

CAUTION: CHECK TO BE SURE THAT THE 618T-( ) BLOWER OPERATES WHEN POWER IS APPLIED TO THE UNIT. IF IT DOES NOT, SET THE 714E-( ) MODE SELECTOR SWITCH TO OFF IMMEDIATELY.

(3) With the 618T-( ) unkeyed, set the front panel meter selector switch to 28V and 130V. The front panel meter should indicate in the red area at both switch positions.

(4) Set the 618T-( ) operating frequency to a frequency of WWV. WWV transmits on 2.500, 5.000, 10.000, 15.000, 20.000, and 25.000 mc.

(5) Adjust the 714E-( ) RF SENS control for a comfortable listening level.

(6) At a time when WWV is making a voice transmission, switch the 618T-( ) between USB and LSB. The voice quality should be equally good in both USB and LSB.

(7) Set the 618T-( ) operating frequency to one on which transmissions may be made.

(8) Key the 618T-( ).

CAUTION: THE 618T-( ) BLOWER SPEED SHOULD INCREASE WHEN THE 618T-( ) IS KEYED. THIS IS INDICATED BY HIGHER-PITCHED BLOWER NOISE. IF THE SPEED DOES NOT INCREASE, UNKEY THE 618T-( ) IMMEDIATELY.

(9) Set the front panel meter selector switch to 1500V, 130V, and 28V. The front panel meter should indicate in the red area at each of these switch positions.

(10) Set the front panel meter selector switch to PA MA. Disconnect the coaxial jumper from the 500 KC STD. connector at the right front of the 618T-( ), and note the front panel meter indication. It should be 300 ma (3 on the meter scale). Reconnect the coaxial jumper.

(11) Make test transmissions in the USB, LSB, and AM modes. Note that sidetone is present in all modes. Note the quality of the sidetone audio.

(12) If possible, establish two-way communications with another station. Obtain signal quality reports from the other station, and note received signal quality.

NOTE: If any of the preceding checks indicate that the 618T-( ) is not operating properly, remove the 618T-( ) to a test bench and perform the 618T-( ) unit performance check.

4. UNIT PERFORMANCE CHECK.

A. Test Equipment.

The following test equipment, or equivalent, is required to perform the 618T-( ) unit performance check.

(1) 115-volt, 400-cps, 3-phase power source.

(2) +28-volt power source.

(3) Test Harness 678P-1 with 714E-( ) Control Unit.

(4) Maintenance Kit 678Y-1.

(5) Function Test Set 678Z-1.

(6) HP-606A signal generator with 80-ZH3 attenuator.

(7) HP-200AB audio oscillator.

(8) HP-410B vtvm with 455A probe "T" CONNECTOR.

(9) Ballantine 310A vtvm.

(10) Bird 82C dummy load.

B. Equipment Setup.

(1) Place the 618T-( ) on the test fixture supplied in Maintenance Kit 678Y-1. Leave all 618T-( ) dust covers in place.

(2) Set Test Harness 678P-1 controls as listed in the chart at the right.

(3) Connect P40 (the 60-pin connector) at the rear of the 618T-( ) to the 618T-1 or 618T-2/3 connector on the top of the 678P-1, depending on the type of 618T-( ) being connected. Use the pendant cable supplied with the 678P-1. Set the 618T-2/618T-3 switch on the 678P-1 to the applicable position. If a 618T-1 is being checked, set this switch to OFF.

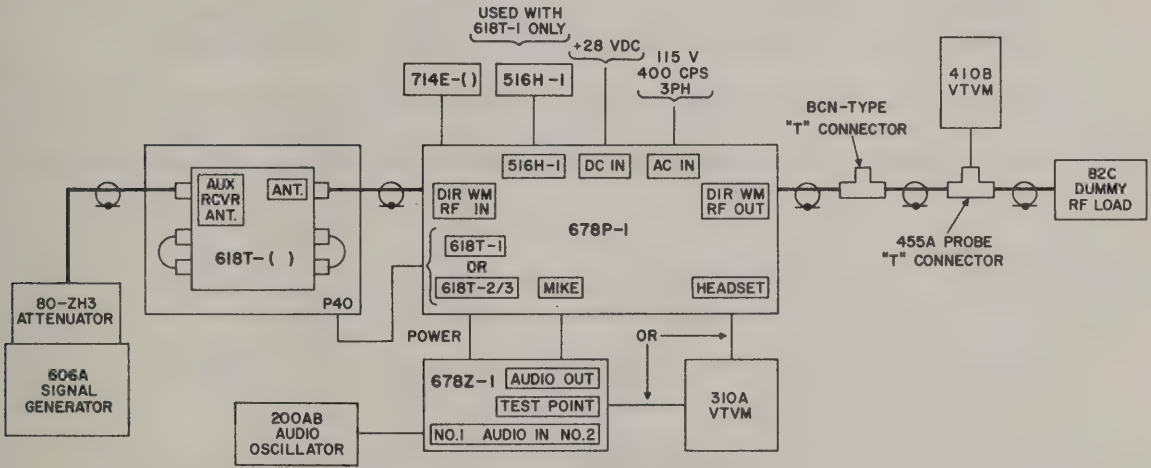
(4) If a 618T-1 is being checked, connect Power Supply 516H-1 to the 516H-1 connector on the top of the 678P-1.

(5) Connect Control Unit 714E-( ) in place in the 678P-1. Set the 714E-1/714E-2/3 switch to the applicable position.

CONTROL	SETTING
KEY INTLK	BYPASS
AC	OFF
DC POWER	OFF
300 Ω AUDIO LOAD	IN
CW KEY	center (off) position
KEY	center (off) position
WATTS	FORWARD, 200

(6) Connect the 115-volt, 400-cps and +28-volt power supplies to the 678P-1 AC IN and DC IN connectors respectively.

(7) Refer to figure 701. Connect the other test equipment as shown in this figure.



NOTES:

1. SET 678P-1 CONTROLS AS FOLLOWS:
   KEY INTLK — BY PASS
   618T-2/OFF/618T-3 — AS REQUIRED (SET TO OFF FOR 618T-1)
   WATTS — FORWARD, 200
   300Ω AUDIO LOAD — IN
   714E-1/714E-2/3 — AS REQUIRED
2. SET "ANT JUMPER" TOGGLE SWITCH UNDER 618T-( ) FRONT PANEL TO "OUT".
3. SET "AUDIO" CONTROL ON 618T-( ) FRONT PANEL AND 714E-( ) "RF SENS" CONTROL FULLY CLOCKWISE.

618T-( ) Test Setup Diagram
Figure 701

(8) Set the ANT JUMPER toggle switch in the 618T-( ) antenna transfer relay compartment to OUT. This switch is accessible by removing the front meter panel from the 618T-( ). After setting this switch, replace the meter panel and filter.

(9) Set the AUDIO control, R10 on the 618T-( ) front panel, fully clockwise.

(10) Check that the four fuses on the top of the 678P-1 are good and have the proper rating.

(11) Set the 678P-1 AC and DC POWER switches to ON.

(12) Set the 714E-( ) mode selector switch to USB, LSB, or AM.

CAUTION: CHECK TO BE SURE THAT THE 618T-( ) BLOWER OPERATES WHEN PRIMARY POWER IS APPLIED TO THE 618T-( ), SO THAT COOLING AIR IS SUPPLIED TO THE UNIT WHILE IT IS BEING CHECKED AND ADJUSTED.

C. Procedures.

NOTE: Table 702 is the data sheet for recording unit performance check data.

(1) Frequency Checks.

(a) Connect the HP-524D frequency counter, through the 2- to 8-mc capacity voltage divider supplied in Maintenance Kit 678Y-1, to the 618T-( ) r-f output.

(b) Set the 618T-( ) to AM.

(c) Check the r-f output frequency at each of the frequencies between 2.000-mc and 2.999-mc listed on the data sheet. Limits are given on the data sheet.

(d) Replace the 2- to 8-mc capacity voltage divider with the 8- to 30-mc divider.

(e) Repeat the frequency checks between 29.000 mc and 29.999 mc. Limits are on the data sheet.

(2) Receive Checks.

(a) Receive Gain/Sensitivity Check (USB and LSB).

Check the USB and LSB receive gain and sensitivity at each of the 28 frequencies listed on the data sheet as follows:

1. Set the 618T-( ) to the listed operating frequency, USB.

2. Set the 606A signal generator output to the same 618T-( ) operating frequency as in the preceding step, 3 uv, cw. Tune the signal generator slightly (about 1 kc) above the 618T-( ) operating frequency to peak the voltage at the 678P-1 HEADSET jack. Record the voltage at the HEADSET jack in the GAIN - USB column on the data sheet.

3. Detune the signal generator at least 10 kc, and note the decrease (in db) in voltage at the HEADSET jack from the voltage noted in the preceding step. Record the db voltage decrease in the SENSITIVITY - USB column on the data sheet.

4. Repeat the above procedure for LSB. To do this, set the 618T-( ) to LSB, and tune the signal generator below the 618T-( ) operating frequency to peak the voltage at the HEADSET jack.

(b) Receive Gain/Sensitivity Check (AM).

Check the AM receive gain and sensitivity at each of the 28 frequencies listed on the data sheet as follows:

1. Set the 618T-( ) to the listed operating frequency, AM.

2. Set the 606A signal generator output to the same 618T-( ) operating frequency as in the preceding step, 5 uv, 30-percent modulated with 1000 cps. Tune the signal generator slightly to peak the voltage at the 678P-1 HEADSET jack. Record the voltage at the HEADSET jack in the GAIN - AM column on the data sheet.

3. Turn off the signal generator modulation, and note the decrease (in db) in voltage at the HEADSET jack from the voltage noted in the preceding step. Record the db voltage decrease in the SENSITIVITY - AM column on the data sheet.

(c) AGC Characteristics.

1. Set the 618T-( ) to 7.300 mc, AM.

2. Set the 606A signal generator output to 7.300 mc, 10 uv, 30-percent modulated with 1000 cps. Tune the signal generator slightly around 7.300 mc to peak the voltage at the 678P-1 HEADSET jack.

3. Note the voltage at the HEADSET jack.

4. Increase the signal generator output level to 100,000 uv. Note the increase (in db) in voltage at the HEADSET jack from the voltage noted in the preceding step. This increase should be not more than 6 db.

5. Set the 618T-( ) to 7.300 mc, USB.

6. Set the 606A signal generator output to 7.300 mc, 10 uv, cw. Tune the signal generator slightly (about 1 kc) above 7.300 mc to peak the voltage at the HEADSET jack.

7. Note the voltage at the HEADSET jack.

8. Increase the signal generator output level to 100,000 uv. Note the increase (in db) in voltage at the HEADSET jack from the voltage noted in the preceding step. This increase should be not more than 6 db.

(3) Transmit Checks.

(a) Power Amplifier Static Plate Current Tube Balance Check.

1. Disconnect the coaxial jumper between the 500 KC STD and 500 KC REF connectors at the right front of the 618T-( ). This removes power amplifier drive, permitting static plate current measurements to be made.

2. Set the front panel meter selector switch to PA MA.

3. Key the 618T-( ). The front panel meter should indicate 300 ma (3 on the meter scale).

4. Unkey the 618T-( ). Press switch S4 in the power amplifier module with the eraser end of a pencil. Key the 618T-( ). The meter should indicate 80 to 120 ma less than the indication in step 3.

5. Repeat step 4. with S5 in the power amplifier module pressed. The meter indication should again be 80 to 120 ma less than the indication in step 3.

6. Reconnect the coaxial jumper at the front of the 618T-( ).

(b) Output Power/Residual Noise Check.

Check the 618T-( ) r-f output power and residual noise at each of the 28 frequencies listed on the data sheet as follows:

1. Set the 618T-( ) to AM.

2. Set the 618T-( ) operating frequency to each of the frequencies listed on the data sheet.

3. Key the 618T-( ). Allow tuning to complete. Record the 618T-( ) r-f output voltage on the data sheet. Unkey the 618T-( ).

4. Disconnect all audio inputs to the 618T-( ).

5. Set the 618T-( ) to USB. Key the 618T-( ). Record the 618T-( ) r-f output voltage on the data sheet. Unkey the 618T-( ).

6. Set the 618T-( ) to LSB. Key the 618T-( ). Record the 618T-( ) r-f output voltage on the data sheet. Unkey the 618T-( ).

(c) CW Output Check.

1. Set te 618T-( ) to CW, any frequency.

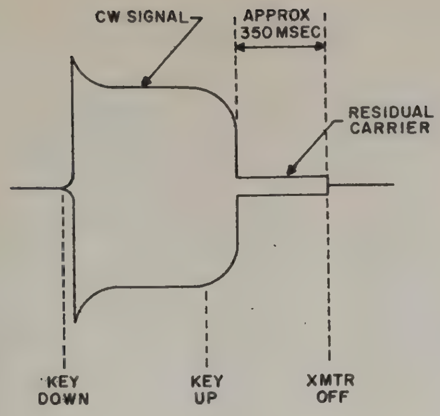
2. Rapidly operate the CW KEY switch on the 678P-1. The 618T-( ) r-f output waveform should be as shown in figure 702, and the r-f output voltage should be between 70 and 90 volts rms when the transmitter is keyed.

(d) AM Modulation Check.

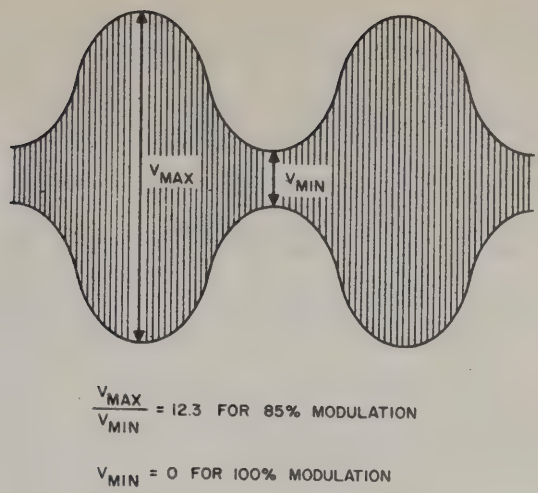
1. Set the 618T-( ) to 7.300 mc, AM.

2. Set the 200AB audio oscillator output to 2000 cps.

3. Key the 618T-( ). Increase the audio oscillator output level until the oscilloscope connected to the 618T-( ) r-f output indicates 100-percent modulation, or, if 100-percent modulation cannot be reached, until the voltage at the 678Z-1 TEST POINT is 0.25 volt rms. The oscilloscope should indicate at least 85-percent modulation, as shown in figure 703.



CW Output Waveform
Figure 702



AM Modulation Waveform
Figure 703

(e) Sidetone Check.

1. Connect a microphone and headset to the 618T-( ) MIC and PHONE jacks.

2. Key the 618T-( ) at any frequency.

3. Monitor the transmitter sidetone while speaking into the microphone. Note the sidetone audio quality.

(4) Antenna Coupler Power/Control Checks.

Refer to table 701 for checks of 618T-( ) outputs and inputs associated with antenna coupler control functions. These checks are made at pins of the 618T-1 or 618T-2/3 connector on the top of Test Harness 678P-1. Use the connector which is not being used for connection to the 618T-( ). Use the 410B vtvm to make these checks.

TABLE 701. ANTENNA COUPLER POWER/CONTROL TEST POINT AT P41, 618T-( )

TEST POINT	QUANTITY BEING TESTED	TEST CONDITIONS	NORMAL INDICATION
P40-5	Transmitter key interlock	678P-1 KEY INTLK switch at NORMAL	0 volts
		678P-1 KEY INTLK switch at BY PASS	+28 volts
P40-7	+260-volt output	Power on	+260 volts
P40-9	Chopper enable	Receive	∞ ohms
		Transmit	0 ohm
P40-10	Tune power enable	Normal operation	∞ ohms
		678P-1 TUNE POWER button pressed	0 ohm

TABLE 701. ANTENNA COUPLER POWER/CONTROL TEST POINT AT P41, 618T-( ) (Cont)

TEST POINT	QUANTITY BEING TESTED	TEST CONDITIONS	NORMAL INDICATION
P40-11	115-volt, 400-cps output	Power on	115 volts rms
P40-26	Recycle line	Normal operation	∞ ohms
		618T-( ) recycling	0 ohm
P40-55	Key line	Receive	∞ ohms
		Transmit	0 ohm
P40-56	+28-volt output	Power on	+28 volts
NOTE: All continuity measurements made between indicated point and 618T-( ) chassis.			

5. UNIT ADJUSTMENTS.

The audio and sidetone level adjustments should be performed before returning the 618T-( ) from the test bench to its installation.

The driver plate tuning, power amplifier static plate current, and tgc adjustments should be performed whenever the r-f translator or power amplifier modules in the 618T-( ) are replaced.

After performing these adjustments and before returning the 618T-( ) to its installation, repeat the unit performance check to ensure that the 618T-( ) is operating properly.

Refer to figure 704 for the location of the 618T-( ) unit adjustments.

A. Test Equipment.

The test equipment required to perform the unit adjustments is the same as that required for the unit performance check, paragraph 4.A.

B. Equipment Setup.

The equipment setup for the unit adjustments is the same as for the unit performance check, paragraph 4.B. In addition, remove the 618T-( ) front panel cover and side dust covers.

C. Procedure.

(1) Receive Audio Output Level Adjustment.

(a) Connect the 310A vtvm to the 678P-1 HEADSET jack.

(b) Set the 618T-( ) to 7.300 mc, AM. Set the 714E-( ) RF SENS control fully clockwise.

(c) Set the 606A signal generator output to 7.300 mc, 1000 uv, 30-percent modulated with 1000 cps. Tune the signal generator slightly around 7.300 mc to peak the voltage at the HEADSET jack.

(d) Adjust the AUDIO level control, R10 on the 618T-( ) front panel, for 5.5 volts rms at the HEADSET jack.

TABLE 701. ANTENNA COUPLER POWER/CONTROL TEST POINT AT P41, 618T-( ) (Cont)

TEST POINT	QUANTITY BEING TESTED	TEST CONDITIONS	NORMAL INDICATION
P40-11	115-volt, 400-cps output	Power on	115 volts rms
P40-26	Recycle line	Normal operation	∞ ohms
		618T-( ) recycling	0 ohm
P40-55	Key line	Receive	∞ ohms
		Transmit	0 ohm
P40-56	+28-volt output	Power on	+28 volts
NOTE: All continuity measurements made between indicated point and 618T-( ) chassis.			

5. UNIT ADJUSTMENTS.

The audio and sidetone level adjustments should be performed before returning the 618T-( ) from the test bench to its installation.

The driver plate tuning, power amplifier static plate current, and tgc adjustments should be performed whenever the r-f translator or power amplifier modules in the 618T-( ) are replaced.

After performing these adjustments and before returning the 618T-( ) to its installation, repeat the unit performance check to ensure that the 618T-( ) is operating properly.

Refer to figure 704 for the location of the 618T-( ) unit adjustments.

A. Test Equipment.

The test equipment required to perform the unit adjustments is the same as that required for the unit performance check, paragraph 4.A.

B. Equipment Setup.

The equipment setup for the unit adjustments is the same as for the unit performance check, paragraph 4.B. In addition, remove the 618T-( ) front panel cover and side dust covers.

C. Procedure.

(1) Receive Audio Output Level Adjustment.

(a) Connect the 310A vtvm to the 678P-1 HEADSET jack.

(b) Set the 618T-( ) to 7.300 mc, AM. Set the 714E-( ) RF SENS control fully clockwise.

(c) Set the 606A signal generator output to 7.300 mc, 1000 uv, 30-percent modulated with 1000 cps. Tune the signal generator slightly around 7.300 mc to peak the voltage at the HEADSET jack.

(d) Adjust the AUDIO level control, R10 on the 618T-( ) front panel, for 5.5 volts rms at the HEADSET jack.

TABLE 702. 618T-( ) UNIT PERFORMANCE CHECK DATA SHEET

618T-( ) SERIAL NO.________

DATE ________

FREQUENCY CHECKS

714E-( ) FREQ SETTING (mc)	618T-( ) R-F OUTPUT FREQ (cps)	LIMIT
2.000		714E-( ) freq setting ±3 cps
2.111		
2.222		
2.333		
2.444		
2.555		
2.666		
2.777		
2.888		
2.999		
29.000		714E-( ) freq setting ±24 cps
29.111		
29.222		
29.333		
29.444		
29.555		
29.666		
29.777		
29.888		
29.999		

RECEIVE CHECKS

GAIN/SENSITIVITY

618T-( ) OPERATING FREQUENCY (mc)	GAIN (audio output volts)			SENSITIVITY (db)		
	USB	LSB	AM	USB	LSB	AM
2.100						
3.100						
4.100						
5.100						
6.100						
7.100						
8.100						
9.100						
10.100						
11.100						
12.100						
13.100						
14.100						
15.100						
16.100						
17.100						
18.100						
19.100						
20.100						
21.100						
22.100						
23.100						
24.100						
25.100						
26.100						
27.100						
28.100						
29.100						
	Limit: 2.4 volts rms min with 1-uv r-f input, CW		Limit: 2.4 volts rms min with 3-uv r-f input, 30 percent modulated with 1000 cps	Limit: 10 db min with 1-uv r-f input, CW		Limit: 6 db min with 3-uv r-f input, 30 percent modulated with 1000 cps

AGC characteristics________Check

TRANSMIT CHECKS

OUTPUT POWER/RESIDUAL NOISE

618T-( ) OPERATING FREQUENCY (mc)	OUTPUT POWER (r-f output volts)	RESIDUAL NOISE (r-f output volts)	
	AM	USB	LSB
2.100			
3.100			
4.100			
5.100			
6.100			
7.100			
8.100			
9.100			
10.100			
11.100			
12.100			
13.100			
14.100			
15.100			
16.100			
17.100			
18.100			
19.100			
20.100			
21.100			
22.100			
23.100			
24.100			
25.100			
26.100			
27.100			
28.100			
29.100			
	Limit: 70 to 90 volts rms AM carrier	Limit: 25 volts rms max with no audio input	

Power amplifier static plate current/tube balance________Check

CW output________Check

AM modulation________Check

Sidetone________Check

ANTENNA COUPLER POWER/CONTROL CHECKS

POWER

+260 volts ________Check

115 volts a-c ________Check

+28 volts ________Check

CONTROL

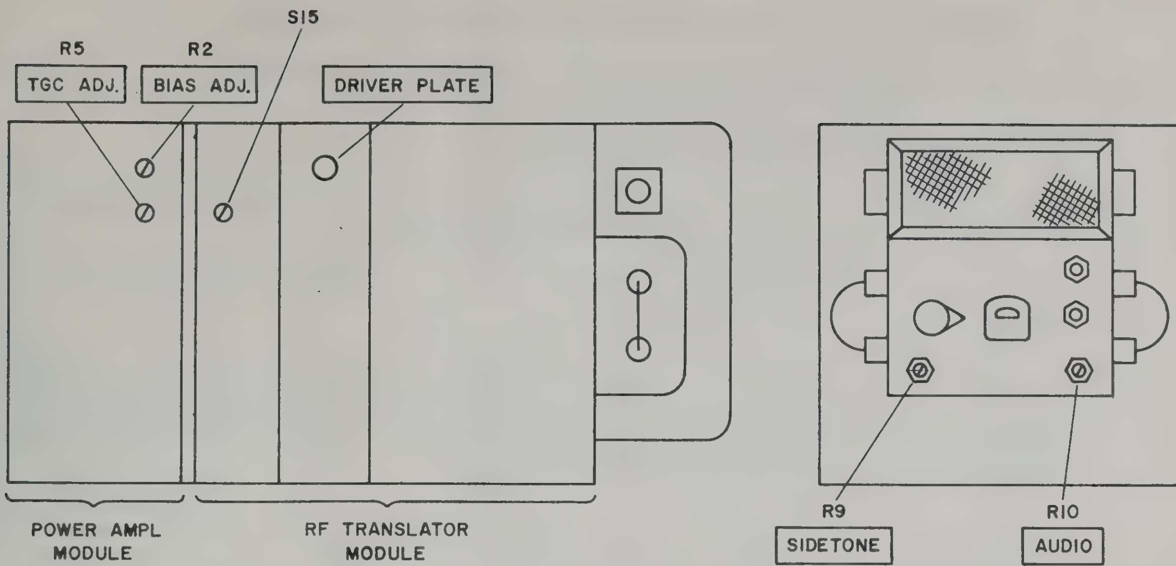
Transmitter key interlock ________Check

Chopper enable ________Check

Tune power enable ________Check

Recycle line ________Check

Key line ________Check



618T-( ) Unit Adjustments
Figure 704

(2) Sidetone Output Level Adjustment.

(a) Connect the Ballantine 310A vtvm to the 678Z-1 TEST POINT.

(b) Key the 618T-( ).

(c) Set the HP-200AB audio oscillator output to 2000 cps, 0.25 volt rms as measured at the TEST POINT.

(d) Connect the 310A vtvm to the 678P-1 HEADSET jack.

(e) Adjust the SIDETONE level control, R9 on the 618T-( ) front panel, for 5.5 volts rms at the HEADSET jack.

(3) Driver Plate Tuning Adjustment.

(a) Connect the HP-410B vtvm a-c probe to the 618T-( ) r-f output.

(b) Connect the red jack on the 678Z-1 labeled J2-FREQ DIV to J2 (red) in the frequency divider module.

(c) Connect the white jack on the 678Z-1 labeled J2-IF TRANS to J2 (red) in the if translator module.

(d) Connect the black jack on the 678Z-1 labeled GRND to the 618T-( ) chassis.

(e) Set the 678Z-1 TGC & CAPTURE RANGE control, R3, fully counterclockwise.

(f) Set the 678Z-1 FUNCTION SELECTOR switch to TGC OVERRIDE.

(g) Set S15 in the r-f translator module counterclockwise to OFF.

(h) Set the 618T-( ) to 29.000 mc, AM.

(i) Key the 618T-( ). Adjust the 678Z-1 TGC & CAPTURE RANGE control, R3, to give a 618T-( ) r-f output voltage of about 50 volts rms.

(j) Adjust the DRIVER PLATE coil in the r-f translator module to peak the r-f output voltage.

(k) Set the 618T-( ) operating frequency to 28.000 mc, 27.000 mc, etc., through 3.000 mc. At each frequency setting, adjust the DRIVER PLATE coil to peak the r-f output voltage. Keep the r-f output voltage at about 50 volts rms by adjusting the 678Z-1 TGC & CAPTURE RANGE control, R3.

NOTE: There is no DRIVER PLATE adjustment at 2.000 mc.

(l) When the DRIVER plate coils have been adjusted on all bands, return S15 in the r-f translator module to ON.

(4) Static Plate Current Adjustment.

(a) Disconnect the coaxial jumper between the 500 KC STD and 500 KC REF connectors at the right front of the 618T-( ).

(b) Set the front panel meter selector switch to PA MA.

(c) Key the 618T-( ).

(d) Adjust R2 in the power amplifier module, the BIAS ADJ. control, until the front panel meter indicates 300 ma (3 on the meter scale).

(e) Unkey the 618T-( ). Reconnect the coaxial jumper at the front of the 618T-( ).

(5) TGC Adjustment.

(a) Set the 618T-( ) to 29.900 mc, AM.

(b) Key the 618T-( ).

(c) Adjust the TGC ADJ control, R5 in the power amplifier module, to give 72 volts rms at the 618T-( ) r-f output.

6. MODULE CHECKS AND ADJUSTMENTS.

Figures 705 through 717 contain module check and adjustment procedures. All of these procedures are performed with the modules connected to an operating 618T-( ) unit.

Refer to table 703 for the figure number corresponding to each 618T-( ) module.

TABLE 703. MODULE CHECK AND ADJUSTMENT FIGURES

MODULE	COLLINS PART NUMBER	FIGURE
Low-voltage power supply	544-9292-00	705
High-voltage power supply	545-5858-00, 544-9291-00, or 545-4971-00	706
AM/audio amplifier	546-6053-00	707
I-f translator	544-9286-00	708
R-f translator	528-0113-00 or 544-9284-00	709
Power amplifier	544-9283-00	710
Electronic control amplifier	544-9290-00	711
R-f oscillator	528-0251-005	712
Frequency divider	546-21[illegible]2-005	713
Kilocycle-frequency stabilizer	528-0112-005 or 544-9288-005	714
Megacycle-frequency stabilizer	528-0239-005	715
R-f oscillator	544-9285-005	716
Megacycle-frequency stabilizer	544-9289-005	717

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tment.

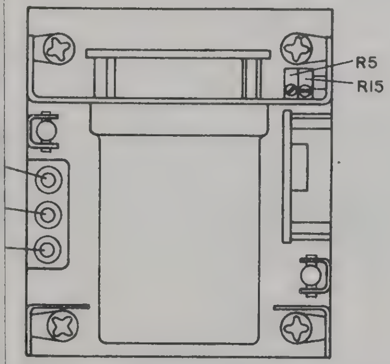
k on the 678Z-1 labeled J2-FREQ DIV to J2 in the frequency

jack on the 678Z-1 labeled GRND to the 618T-( ) chassis.

CTION SELECTOR switch to SET LEVEL. Adjust the LEVEL til the FUNCTION METER indicates +10. Do not use the X10 Y switch.

CTION SELECTOR switch to +18V. The FUNCTION METER scale division when the X10 METER SENSITIVITY switch is imes. If it does not, adjust R15 for the proper indication.

panel meter selector switch to 130V. The front panel meter red area. If it does not, check components in the +130-volt voltage power supply module.



Low-Voltage Power Supply Module,
Checks and Adjustments
Figure 705

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1. LOW-VOLTAGE POWER SUPPLY MODULE TEST POINT DATA.

TEST POINT	QUANTITY BEING TESTED	TEST CONDITIONS	NORMAL INDICATION
J1	Blanker trigger	J1 ungrounded	+18 volts at J3
		J1 grounded	0 volt at J3
J2	Blanker input voltage	Power on	+28 volts
J3	Regulator output voltage	Power on	+18 volts

2. LOW-VOLTAGE POWER SUPPLY MODULE CHECKS AND ADJUSTMENTS.

A. Test Equipment.

The following test equipment, or equivalent, is required to check and adjust the low-voltage power supply module.

(1) Test Harness 678P-1.

(2) Maintenance Kit 678Y-1.

(3) Function Test Set 678Z-1.

(4) HP-410B vtvm.

(5) Variable d-c voltage source (+25 to +35 volts).

B. Equipment Setup.

Connect the 618T-( ) and test equipment as shown in figure 701. Connect the low-voltage power supply module to the 618T-( ) chassis through the module extender supplied in Maintenance Kit 678Y-1. Leave all other modules in place on the chassis.

C. Procedure.

(1) Blanker Adjustment.

(a) Connect the low-voltage power supply module to its module extender, but do not connect the extender to the 618T-( ) chassis.

(b) Connect the variable d-c voltage source to TP4 on the module extender. Set the voltage to +28 volts.

(c) Connect the 410B vtvm d-c probe to TP5 on the module extender.

(d) Increase the variable d-c voltage slowly until the voltage at TP5 abruptly drops to 0. Note the variable d-c voltage at this point. It should be +32 ±0.5 volts. If it is not, set the variable d-c voltage to +32 ±0.5 volts and adjust R5 until the voltage at TP5 drops to 0. Then repeat steps (a) through (d).

(2) +18 Volt Regulator Adjustment.

(a) Connect the red jack on the 678Z-1 labeled J2-FREQ DIV to J2 in the frequency divider module.

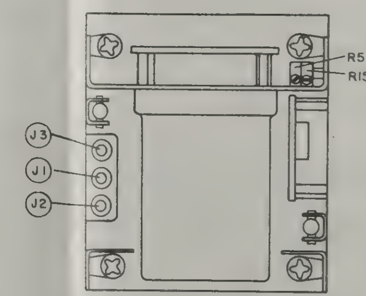
(b) Connect the black jack on the 678Z-1 labeled GRND to the 618T-( ) chassis.

(c) Set the 678Z-1 FUNCTION SELECTOR switch to SET LEVEL. Adjust the LEVEL SET control, R1, until the FUNCTION METER indicates +10. Do not use the X10 METER SENSITIVITY switch.

(d) Set the 678Z-1 FUNCTION SELECTOR switch to +18V. The FUNCTION METER should indicate 0 ±1 scale division when the X10 METER SENSITIVITY switch is operated several times. If it does not, adjust R15 for the proper indication.

(3) +130-Volt Supply Check.

Set the 618T-( ) front panel meter selector switch to 130V. The front panel meter should indicate in the red area. If it does not, check components in the +130-volt supply circuit in the low-voltage power supply module.



Low-Voltage Power Supply Module,
Checks and Adjustments
Figure 705

1. HIGH-VOLTAGE POWER SUPPLY MODULE CHECKS.

A. Test Equipment.

The following test equipment, or equivalent, is required to check the high-voltage power supply module.

(1) Test Harness 678P-1.

(2) Maintenance Kit 678Y-1.

(3) HP-410B vtvm.

(4) Triplett 630-NA vom.

(5) Bird 82C dummy load.

B. Equipment Setup.

Leave the high-voltage power supply module and all other modules, except the r-f translator, connected to the 618T-( ) chassis. Connect the r-f translator module to the 618T-( ) chassis through the module extender supplied in Maintenance Kit 678Y-1.

C. Procedure.

(1) Set the front panel meter selector switch to 1500V.

(2) Key the 618T-( ). The front panel meter should indicate in the red area.

(3) Connect the HP-410B vtvm d-c probe to TP19 (J32) on the r-f translator module extender.

(4) Key the 618T-( ). The voltage at TP19 should be +260 ±26 volts.

NOTE: There are no adjustments in the high-voltage power supply module. If the preceding checks indicate that the module outputs are abnormal, remove the module from the 618T-( ), and use an ohmmeter to check for faulty diodes, transformer winding continuity, and proper relay operation. Refer to the module schematic diagram.

High-Voltage Power Supply Module, Checks
Figure 706

should be 8 (or 12) volts rms. If it is not, adjust R5 for . Recheck the audio oscillator output voltage to be sure 8 (or 12) volts rms at J4.

per from the RCVR IF. IN connector at the left front of 606A signal generator output, through the 80-ZH3 .

utput to 500 kc, 30 percent modulated with 1000 cps. r output level to give 2 to 3 volts rms at the 678P-1

l T2 to peak the voltage at the HEADSET jack.

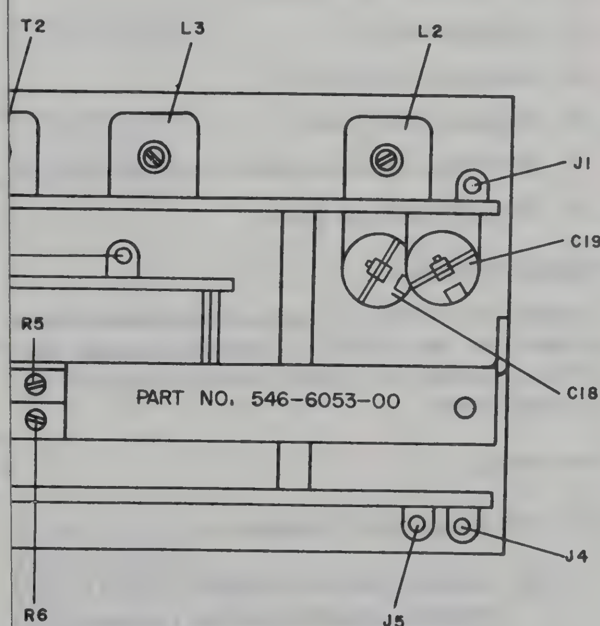
r output level to 300 uv.

at the HEADSET jack.

r output level for 5 volts rms at the HEADSET jack.

output level. It should be between 100 and 200 uv. If value of resistance that will give the proper indication.

ator from the RCVR IF. IN connector. Reconnect the ctor.



AM/Audio Amplifier Module,
Checks and Adjustments
Figure 707

1. HIGH-VOLTAGE POWER SUPPLY MODULE CHECKS.

A. Test Equipment.

The following test equipment, or equivalent, is required to check the high-voltage power supply module.

(1) Test Harness 678P-1.

(2) Maintenance Kit 678Y-1.

(3) HP-410B vtvm.

(4) Triplett 630-NA vom.

(5) Bird 82C dummy load.

B. Equipment Setup.

Leave the high-voltage power supply module and all other modules, except the r-f translator, connected to the 618T-( ) chassis. Connect the r-f translator module to the 618T-( ) chassis through the module extender supplied in Maintenance Kit 678Y-1.

C. Procedure.

(1) Set the front panel meter selector switch to 1500V.

(2) Key the 618T-( ). The front panel meter should indicate in the red area.

(3) Connect the HP-410B vtvm d-c probe to TP19 (J32) on the r-f translator module extender.

(4) Key the 618T-( ). The voltage at TP19 should be +260 ±26 volts.

NOTE: There are no adjustments in the high-voltage power supply module. If the preceding checks indicate that the module outputs are abnormal, remove the module from the 618T-( ), and use an ohmmeter to check for faulty diodes, transformer winding continuity, and proper relay operation. Refer to the module schematic diagram.

High-Voltage Power Supply Module, Checks
Figure 706

1. AM/AUDIO AMPLIFIER MODULE TEST POINT DATA.

TEST POINT	QUANTITY BEING TESTED	TEST CONDITIONS	NORMAL INDICATION
J1	I-f agc voltage	Used for alignment only	
J2	AM detector output	Used for alignment only	
J3	Audio amplifier input	Used for alignment only	
J4	Audio amplifier output	Used for alignment only	
J5	R-f agc voltage	Used for alignment only	
J6	Selcal audio output	Used for alignment only	

2. AM/AUDIO AMPLIFIER MODULE CHECKS AND ADJUSTMENTS.

A. Test Equipment.

The following test equipment, or equivalent, is required to check and adjust the AM/audio amplifier module.

(1) Test Harness 678P-1.

(2) Maintenance Kit 678Y-1.

(3) Function Test Set 678Z-1.

(4) HP-410B vtvm.

(5) Ballantine 310A vtvm.

(6) HP-606A signal generator with 80-ZH3 attenuator.

(7) HP-200AB audio oscillator.

(8) Bird 82C dummy load.

B. Equipment Setup.

Connect the 618T-( ) and test equipment as shown in figure 701. Connect the AM/audio amplifier module to the 618T-( ) chassis through the module extender supplied in Maintenance Kit 678Y-1. Leave all other modules in place on the chassis. Remove the AM/audio amplifier module dust cover.

C. Procedure.

(1) Audio Amplifier Gain Adjustment.

(a) Connect the 310A vtvm to J4.

(b) Key the 618T-( ). Set the 200AB audio oscillator output to 1000 cps, 0.25 volt rms as measured at the 678Z-1 TEST POINT.

(c) Note the voltage at J4. It should be 8 volts rms (or 12 volts rms if the module MCN is below 3508). If it is not, adjust R6 for 8 (or 12) volts rms at J4. Recheck the voltage at the 678Z-1 TEST POINT to be sure that it is 0.25 volt rms with 8 (or 12) volts rms at J4.

(d) Connect the 200AB audio oscillator directly to the 678P-1 600 Ω BAL AUDIO IN jack. Connect the oscillator for a balanced output.

(e) Key the 618T-( ). Set the 200AB audio oscillator output to 1000 cps, 0.78 volt rms.

(f) Note the voltage at J4. It should be 8 (or 12) volts rms. If it is not, adjust R5 for 8 (or 12) volts rms at J4. Recheck the audio oscillator output voltage to be sure that it is 0.78 volt rms with 8 (or 12) volts rms at J4.

(2) AM Receive I-F Alignment.

(a) Set the 618T-( ) to AM.

(b) Disconnect the coaxial jumper from the RCVR IF. IN connector at the left front of the 618T-( ). Connect the 606A signal generator output, through the 80-ZH3 attenuator, to this connector.

(c) Set the signal generator output to 500 kc, 30 percent modulated with 1000 cps. Adjust the signal generator output level to give 2 to 3 volts rms at the 678P-1 HEADSET jack.

(d) Adjust C18, C19, L2, L3, and T2 to peak the voltage at the HEADSET jack.

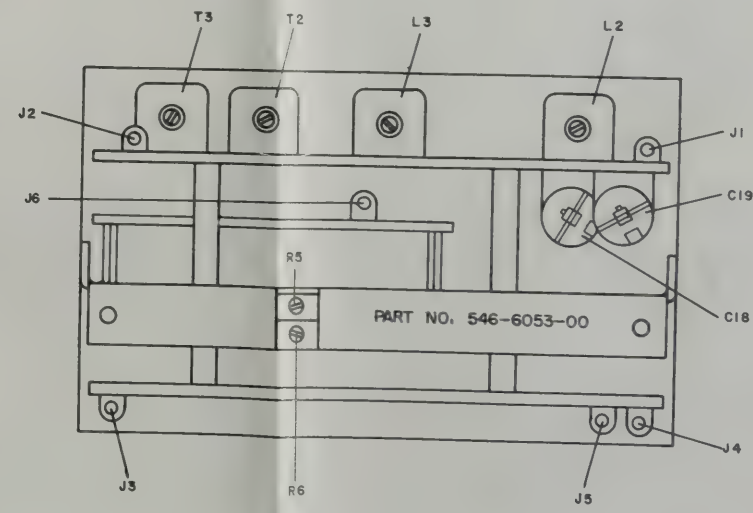
(e) Increase the signal generator output level to 300 uv.

(f) Adjust T3 to null the voltage at the HEADSET jack.

(g) Adjust the signal generator output level for 5 volts rms at the HEADSET jack.

(h) Note the signal generator output level. It should be between 100 and 200 uv. If it is not, replace R56 with a value of resistance that will give the proper indication.

(i) Disconnect the signal generator from the RCVR IF. IN connector. Reconnect the coaxial jumper to this connector.



AM/Audio Amplifier Module,
Checks and Adjustments
Figure 707

n sideband. Note the voltage at the RF test point. 39 volt rms. If it is not, replace R2 with a value)per voltage at the RF test point.

gain sideband. The voltage at the RF test point tage noted in the preceding step. If it is not, re- stance that will give the proper voltage at the RF

)nnector on the module extender to the unmarked with the coaxial jumper.

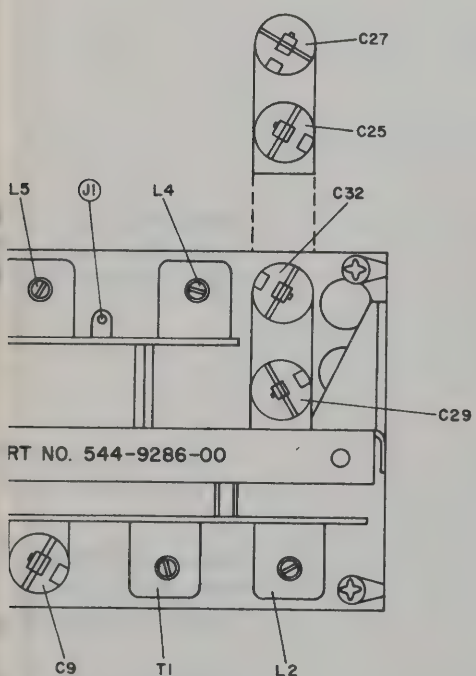
est point on the module extender.

, then C9, to null the voltage at the RF test point.

, then C9, to null the voltage at the RF test point.

ne null voltage is USB and LSB are approximately)uld be about 0.35 volt rms.

ecommended for accurate carrier balance. For rum analyzer, override the tgc, and adjust the r-f s rms in AM. Then switch to USB and LSB and e carrier.



Iodule, Checks and Adjustments
Figure 708

alignments are made in the r-f trans-
cal alignment procedures in steps (a)

form the variable/band-pass i-f align-
wing alignment procedure is required.

)0 mc.

ator output level for 0.5 volt rms at J2.

ile making the following adjustments by
level.

e voltage at J2. These adjustments are
nearest filter FL1.

band-pass i-f alignment check. If this
-pass i-f filter is not aligned properly,

10, with a 6AH6WA with pin 1 cut off.

dule chassis through the 9-pin tube ex-

through the 80-ZH3 attenuator, to pin 2
mc.

6 of V2.

)0 mc.

erator output level until the 410B vtvm

stments are accessible through the r-f
FL1. Refer to the silk screen near the
of specific test points and adjustments.

n.

n.

1. I-F TRANSLATOR MODULE TEST POINT DATA.

TEST POINT	QUANTITY BEING TESTED	TEST CONDITIONS	NORMAL INDICATION
J1	I-f agc voltage	Used for alignment only	
J2	Tgc voltage		+10 to +14 volts
J3	Audio input to balanced modulator	Used for alignment only	
J4	500-kc carrier input to balance modulator		1.5 volt rms

2. I-F TRANSLATOR MODULE CHECKS AND ADJUSTMENTS.

A. Test Equipment.

The following test equipment, or equivalent, is required to check and adjust the i-f translator module.

(1) Test Harness 678P-1.

(2) Maintenance Kit 678Y-1.

(3) Function Test Set 678Z-1.

(4) HP-410B vtvm.

(5) Ballantine 310A vtvm.

(6) Boonton 91-C vtvm.

(7) HP-606A signal generator with 80-ZH3 attenautor.

(8) Bird 82C dummy load.

B. Equipment Setup.

Connect the 618T-( ) and test equipment as shown in figure 701. Connect the i-f translator module to the 618T-( ) chassis through the module extender supplied in Maintenance Kit 678Y-1. Leave all other modules in place on the chassis. Remove the i-f translator module dust cover.

C. Procedure.

(1) SSB Receive I-F Alignment.

(a) Connect the IF OUTPUT coaxial connector on the module extender to the unmarked coaxial connector on the extender with the coaxial jumper.

(b) Set the 618T-( ) to USB.

(c) Disconnect the coaxial jumper from the RCVR IF. IN connector at the left front of the 618T-( ). Connect the 606A signal generator output, through the 80-ZH3 attenuator, to this connector.

(d) Tune the signal generator to 500.3 kc, CW. Adjust the signal generator output level for 2 to 3 volts rms at the 678P-1 HEADSET jack.

(e) Adjust L4, L5, and T2 to peak the voltage at the HEADSET jack. If necessary, reduce the signal generator output level during this peaking procedure to keep the voltage at the HEADSET jack below 5 volts rms.

(f) Tune the signal generator to 501 kc.

(g) Adjust C25 and C29 to peak the voltage at the HEADSET jack. Again keep this voltage below 5 volts rms during the peaking procedure.

(h) Set the 618T-( ) to LSB.

(i) Tune the signal generator to 499.0 kc.

(j) Adjust C27 and C32 to peak the voltage at the HEADSET jack.

(k) Determine the lower-gain sideband by keeping the signal generator output level constant while switching between LSB (with signal generator tuned to 499.0 kc) and USB (with signal generator tuned to 501.0 kc). The voltage at the HEADSET jack will be lower in the lower-gain sideband.

(l) Set the 618T-( ) to the lower-gain sideband. Adjust the signal generator output level for 5 volts rms at the HEADSET jack.

(m) Note the signal generator output level. It should be between 40 and 100 uv. If it is not, replace R5 with a value of resistance that will give the proper indication.

(n) Disconnect the signal generator from the RCVR IF. IN connector. Reconnect the coaxial jumper to this connector.

(2) SSB/AM Transmit I-F Alignment.

NOTE: Perform the SSB receive i-f alignment procedure before performing this procedure.

(a) Connect the RF LOAD coaxial connector on the module extender to the unmarked coaxial connector on the extender with the coaxial jumper.

(b) Connect the 91-C vtvm to the RF test point on the module extender.

(c) Set the 618T-( ) to USB.

(d) Short C9.

(e) Key the 618T-( ). Adjust T1 and L2 to peak the voltage at the RF test point.

(f) Remove the short from C9.

(g) Set the 618T-( ) to AM.

(h) Note the voltage at the RF test point. It should be between 0.24 and 0.38 volt rms. If it is not, replace R42 with a value of resistance that will give the proper voltage at the RF test point.

(i) Set the 200AB audio oscillator output to 1000 cps, 0.25 volt as measured at the 678Z-1 TEST POINT.

(j) Determine the lower-gain sideband by keying the 618T-( ) and switching between LSB and USB. The setting that gives the lower voltage at the RF test point is the lower-gain sideband.

(k) Set the 618T-( ) to the lower-gain sideband. Note the voltage at the RF test point. It should be between 0.31 and 0.39 volt rms. If it is not, replace R2 with a value of resistance that will give the proper voltage at the RF test point.

(l) Set the 618T-( ) to the higher-gain sideband. The voltage at the RF test point should be within 2 db of the voltage noted in the preceding step. If it is not, replace R45 with a value of resistance that will give the proper voltage at the RF test point.

(3) Carrier Balance Adjustment.

(a) Connect the RF LOAD coaxial connector on the module extender to the unmarked coaxial connector on the extender with the coaxial jumper.

(b) Connect the 91-C vtvm to the RF test point on the module extender.

(c) Set the 618T-( ) to USB.

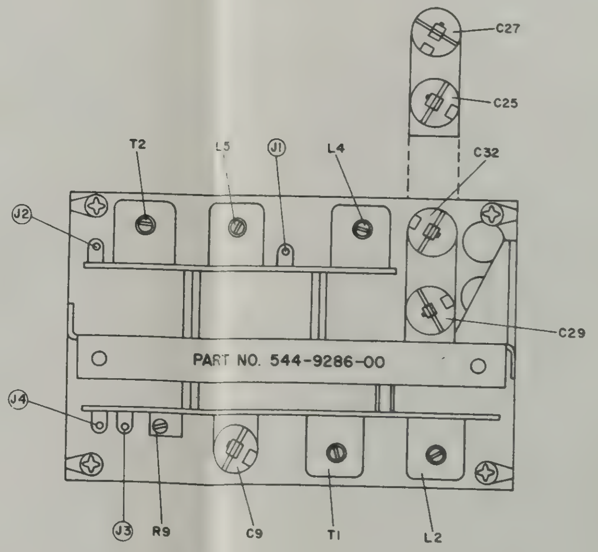
(d) Key the 618T-( ). Adjust first R9, then C9, to null the voltage at the RF test point.

(e) Set the 618T-( ) to LSB.

(f) Key the 618T-( ). Adjust first R9, then C9, to null the voltage at the RF test point.

(g) Repeat steps (c) through (f) until the null voltage is USB and LSB are approximately equal. This voltage at the null should be about 0.35 volt rms.

NOTE: This procedure is not recommended for accurate carrier balance. For best results, use a spectrum analyzer, override the tgc, and adjust the r-f output voltage to 72 volts rms in AM. Then switch to USB and LSB and adjust R9 and C9 to null the carrier.



I-F Translator Module, Checks and Adjustments
Figure 708

1. R-F TRANSLATOR MODULE TEST POINT DATA.

TEST POINT	QUANTITY BEING TESTED	TEST CONDITIONS	NORMAL INDICATION
J1	17.5-mc oscillator output	Power on Operating frequency from 2.000 to 29.999 mc.	0.9 volt rms minimum
J2	Band-pass filter (l-f end)	2.100 mc, AM, transmit	0.05 to 0.35 volt rms
J3	R-f amplifier grid voltage	2.100 mc, AM, transmit	0.05 to 0.2 volt rms
J4	Driver grid voltage	2.100 mc, AM, transmit	2.0 to 4.5 volts rms
J5	Vfo output	Power on	0.8 volt rms minimum
J6	Band-pass filter (h-f end)	Used for alignment only	
J7	H-f oscillator output	Power on	0.8 volt rms minimum
J8	Recycle line	Normal operation	Open
		Recycle condition	Ground
J9	Transmit l-f mixer grid voltage	Used for alignment only	

2. R-F TRANSLATOR MODULE CHECKS AND ADJUSTMENTS.

A. Test Equipment.

The following test equipment, or equivalent, is required to check and adjust the r-f translator module.

(1) Test Harness 678P-1.

(2) Maintenance Kit 678Y-1.

(3) Function Test Set 678Z-1.

(4) HP-410B vtvm.

(5) Boonton 91-C vtvm.

(6) HP-606A signal generator with 80-ZH3 attenuator.

(7) HP-524D frequency counter.

(8) Bird 82C dummy load.

R-F Translator Module, Checks and Adjustments (Sheet 1 of 3)
Figure 709

(9) Tektronix 541 oscilloscope.

(10) Communications Receiver 51S-1.

B. Equipment Setup.

All r-f translator module checks and adjustments except the r-f and i-f circuits alignment, neutralization adjustments, and h-f mixer balance should be performed with the r-f translator module connected in place on the 618T-( ) chassis. Connect the 618T-( ) and test equipment as shown in figure 701. Remove the r-f translator module top cover plate.

For the i-f and r-f circuits alignment, neutralization adjustments, and h-f mixer balance procedures, the test setup, unless otherwise stated in the procedure, is as follows.

(1) Connect the r-f translator module to the 618T-( ) chassis through the module extender supplied in the 678Y-1.

(2) Disconnect the coaxial jumper at J34 on the module extender. Connect the 606A signal generator output, through the 80-ZH3 attenuator, to the module input at J34 on the module extender. Tune the signal generator to 500 kc.

(3) Remove the small block that holds J31 and J30 on the module extender. These jacks mate with plugs P2 and P3 on the r-f translator module.

(4) Connect the RF TRANSLATOR LOAD, supplied in Maintenance Kit 678Y-1, to P2 and P3. Make this connection so that the blue test point on the RF TRANSLATOR LOAD is on the same side as P2.

(5) Connect the 410B vtvm a-c probe to the blue test point on the RF TRANSLATOR LOAD.

C. Procedure.

(1) VFO Phase-Locking Check and Alignment.

(a) Couple the 51S-1 receiver to the vfo output by placing the receiver antenna wire near the vfo case.

(b) Set the 618T-( ) operating frequency to each of the frequencies listed in the chart below. Tune the 51S-1 receiver to the vfo frequency corresponding to the 618T-( ) operating frequency. Note that the vfo frequency is correct.

(c) To check for vfo phase lock, ground TP5 in the kilocycle-frequency stabilizer module. This will unlock the vfo and cause the vfo frequency to vary slightly from the locked frequency. When TP5 is ungrounded, the vfo should relock at the original locked frequency.

NOTE: If the preceding check indicates that the vfo is not phase locking properly, perform the following alignment procedure.

618T-( ) OPERATING FREQUENCY (mc)	VFO FREQUENCY (mc)
X.000	3.500
X.111	3.389
X.222	3.278
X.333	3.167
X.444	3.056
X.555	2.945
X.666	2.834
X.777	2.723
X.888	2.612
X.999	2.501

(d) Adjust the vfo bias as instructed in the kilocycle-frequency stabilizer module adjustment procedure.

(e) Ground TP5 in the kilocycle-frequency stabilizer module.

(f) Connect the 524D frequency counter to J5. Drive the counter through the 541 oscilloscope vertical amplifier. Use the red-barreled test probe with BNC-type connector supplied in Maintenance Kit 678Y-1.

(g) Refer to the vfo case. Note that there are five CALIBRATION SETUP POINTS marked on the vfo case--two on top of the case, and three on the side. These values are the factory-measured deviations from the ideal vfo frequencies for that particular vfo at each of the five points. These deviations are given in cycles per second. Three of these CALIBRATION SETUP POINTS will be needed during the vfo alignment procedure--those at 2.5 mc, 3.0 mc, and 3.5 mc.

(h) Set the 618T-( ) operating frequency to X.500 mc. The frequency counter should indicate 3,000,000 cps ± the value of the 3.0-mc CALIBRATION SETUP POINT ±300 cps. If it does not, loosen the vfo coupling between the vfo and Autopositioner and turn the vfo shaft until the counter indicates the proper frequency. Then tighten the coupling just tight enough to turn the shaft without slipping; further adjustment may be required. Check to see that the Autopositioner shaft coupling is tightened securely.

(i) Set the 618T-( ) operating frequency to X.999 mc. The frequency counter should indicate 2,501,000 cps ± the value of the 2.5-mc CALIBRATION SETUP POINT ±300 cps. If it does not, loosen the vfo coupling and turn the vfo shaft until the counter indicates the proper frequency. Tighten the coupling just tight enough to turn the shaft without slipping.

(j) Set the 618T-( ) operating frequency to X.000 mc. The frequency counter should indicate 3,500,000 cps ± the value of the 3.5-mc CALIBRATION SETUP POINT ±300 cps. If it does not, unscrew the plug from the top of the vfo case and adjust L1 in the vfo until the counter indicates the proper frequency. Replace the plug.

(k) Repeat steps (f) and (g) as many times as necessary to obtain proper frequency indications at both ends of the vfo range. When this has been done, tighten the vfo coupling securely.

(l) Unground TP5 in the kilocycle-frequency stabilizer module.

(m) Repeat the phase-locking check in steps (a) through (c).

NOTE: If the preceding alignment procedure fails to restore vfo phase lock, refer to the kilocycle-frequency stabilizer module and frequency divider module checks and adjustments.

(2) 17.5-Mc Oscillator Phase-Locking Check and Adjustment.

(a) Couple the 51S-1 receiver to the 17.5-mc oscillator output by placing the receiver antenna wire near the oscillator tube, V10.

(b) Set the 618T-( ) operating frequency to any frequency between 2.000 mc and 6.999 mc.

(c) Tune the 51S-1 receiver to 17.500 mc.

(d) To check for oscillator phase lock, ground J3 in the megacycle-frequency stabilizer module. This will unlock the oscillator and cause the oscillator frequency to vary slightly from the locked frequency. When J3 is ungrounded, the oscillator should relock at the original locked frequency.

NOTE: If the preceding check indicates that the 17.5 mc oscillator is not phase locking properly, perform the following adjustment procedure.

(e) Connect the 410B vtvm d-c probe to J3 in the megacycle-frequency stabilizer module.

(f) Adjust L90 until the oscillator locks at 17.500 mc. Continue to adjust L90 slowly until the voltage at J3 in the megacycle-frequency stabilizer module is +7.0 ±0.5 volts.

(g) Connect the 91-C vtvm to J1.

(h) Adjust T4 to peak the voltage at J1.

(i) Repeat the oscillator phase-locking check in steps (a) through (d).

NOTE: If the preceding adjustments fail to restore oscillator phase locking, refer to the megacycle-frequency stabilizer module checks and adjustments.

(3) H-F Oscillator Phase-Locking Check and Adjustment.

(a) Couple the 51S-1 receiver to the h-f oscillator output by placing the receiver antenna wire near the oscillator tube, V11.

(b) Set the 618T-( ) operating frequency to each of the frequencies listed in the chart below. Tune the 51S-1 receiver to the oscillator frequency corresponding to the 618T-( ) operating frequency.

(c) To check for oscillator phase lock, ground J1 in the megacycle-frequency stabilizer module. This will unlock the oscillator and cause the oscillator frequency to vary slightly from the locked frequency. When J1 is ungrounded, the oscillator should relock at the original locked frequency.

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l-c probe to J5.

st R20 to give -4.75 volts at J5.

ADJUSTMENT QUICKLY TO AVOID
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ck on the 678Z-1 labeled GRND to tl

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It should be 161 volts rms maximum.
38 to limit the maximum r-f output volt

EP THE 618T-( ) R-F OUTPUT VOL
E ANY LONGER THAN NECESSARY T
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FULLY COUNTERCLOCKWISE AF

NOTE: If the preceding check indicates that the h-f oscillator is unlocked only on some of the bands, perform the following adjustment procedure. If the oscillator is unlocked on all bands, refer to the megacycle-frequency stabilizer module checks and adjustments.

The following adjustments are made at coil block Z5. Coils in this block may be adjusted through holes in the r-f translator module side plate opposite the gear plate. Refer to the silk screening above the adjustment holes for the number and location of each coil in the block.

(d) Connect the 410B vtvm d-c probe to J1 in the megacycle-frequency stabilizer module.

(e) Set the 618T-( ) operating frequency to the frequency at which the oscillator is unlocked.

(f) Refer to the following chart. Adjust the proper coil in Z5 until the oscillator locks at the correct frequency. Continue to slowly adjust the coil until the voltage at J1 in the megacycle-frequency stabilizer module is -7.0 ±0.5 volts. If, on any band, the coil core adjustment range is insufficient to lock the oscillator, set that core flush with the block surface, then adjust the common (C) coil for proper lock.

NOTE: Whenever the core in the common (C) coil is repositioned, all individual band coils must be readjusted.

618T-( ) OPERATING FREQUENCY (mc)	H-F OSCILLATOR FREQUENCY (mc)	ADJUST
2.XXX	12.500	Z5-2
3.XXX	11.500	Z5-3
4.XXX	10.500	Z5-4
5.XXX	9.500	Z5-5
6.XXX	8.500	Z5-6
7.XXX	10.000	Z5-7
8.XXX	11.000	Z5-8
9.XXX	12.000	Z5-9
10.XXX	13.000	Z5-10
11.XXX	14.000	Z5-11
12.XXX	15.000	Z5-12
13.XXX	16.000	Z5-13
14.XXX	17.000	Z5-14
15.XXX	18.000	Z5-15
16.XXX	19.000	Z5-16
17.XXX	20.000	Z5-17
18.XXX	21.000	Z5-18
19.XXX	22.000	Z5-19
20.XXX	23.000	Z5-20
21.XXX	24.000	Z5-21
22.XXX	25.000	Z5-22
23.XXX	26.000	Z5-23
24.XXX	27.000	Z5-24
25.XXX	28.000	Z5-25
26.XXX	29.000	Z5-26
27.XXX	30.000	Z5-27
28.XXX	31.000	Z5-28
29.XXX	32.000	Z5-29

(g) Connect the 91-C vtvm to J7.

(h) Set the 618T-( ) operating frequency to 6.XXX mc. Adjust the bottom core in T5 to peak the voltage at J7.

(i) Set the 618T-( ) operating frequency to 14.XXX mc. Adjust the top core in T5 to peak the voltage at J7.

(j) Set the 618T-( ) operating frequency to 29.XXX mc. Adjust C187 to peak the voltage at J7.

(k) Repeat steps (h) through (j) once.

(l) Repeat the oscillator phase-locking check in steps (a) through (c).

NOTE: If the preceding adjustments fail to restore oscillator phase locking, refer to the megacycle-frequency stabilizer module checks and adjustments.

(4) Receive Output Adjustment.

(a) Set the 618T-( ) operating frequency to 9.990 mc, AM.

(b) Connect the 606A signal generator output, through the 80-ZH3 attenuator, to the AUX RCVR ANT. connector at the left front of the 618T-( ). Set the signal generator output to 9.990 mc, 30 percent modulated with 1000 cps. Tune the signal generator around 9.990 to peak the voltage at the 678P-1 HEADSET jack. Adjust the signal generator output level to give 3 volts rms at the HEADSET jack.

(c) Adjust T3 to peak the voltage at the HEADSET jack. Keep the voltage at the HEADSET jack below 5 volts rms while making this adjustment by reducing the signal generator output level.

(5) Variable/Band-Pass I-F Alignment Check.

(a) Connect the 410B vtvm a-c probe to J2.

(b) Key the 618T-( ).

(c) Note the voltage at J2 as the 618T-( ) operating frequency is varied from 6.000 mc to 6.999 mc in 100-kc steps. Adjust the 606A signal generator output level for 0.5 volt rms at J2 at 6.000 mc, then leave the signal generator output level constant across the frequency range. If the maximum-to-minimum voltage at J2 is more than 2-to-1 across the frequency range, perform step (d). If the variation is within the specified limits, both the variable and band-pass i-f circuits are aligned properly.

(d) Note the voltage at J2 as the 618T-( ) operating frequency is varied from 8.000 mc to 8.999 mc in 100-kc steps. Adjust the 606A signal generator output level for 0.5 volt rms at J2 at 8.000 mc, then leave the signal generator output level constant across the frequency range. If the maximum-to-minimum voltage at J2 is more than 2-to-1 across the frequency range, perform the variable i-f alignment procedure. If the variation is within the specified limits, perform the band-pass i-f filter alignment procedure.

(6) Variable I-F Alignment.

(a) Ground J3.

(b) Replace the h-f oscillator tube, V11, with a 6AH6WA with pin 1 cut off.

(c) Connect the 410B vtvm a-c probe to J2.

(d) Set the 618T-( ) operating frequency to 8.999 mc.

(e) Key the 618T-( ). Adjust the signal generator output level for 0.5 volt rms at J2.

NOTE: While making the following adjustments, keep the voltage at J2 constant by varying the signal generator output level.

(f) Adjust L2, L3, L4, and L130 to peak the voltage at J2. L130 may be adjusted to give two peaks. Adjust for the peak that gives the highest voltage at J2.

NOTE: If the r-f translator module MCN is below 1508, capacitor C273 replaces L130. The adjustment pocedure is the same.

(g) Set the 618T-( ) operating frequency to 8.000 mc.

(h) Adjust C7, C10, and C13 to peak the voltage at J2.

(i) Repeat steps (e) through (h) until no further improvement can be noted.

NOTE: At this point, repeat the variable/band-pass i-f alignment check. If the check indicates that the variable i-f circuits are still not aligned properly, continue with this procedure.

(j) Set the 618T-( ) operating frequency to X.500 mc.

(k) Check to see that both slug racks are equally high above the chassis (within 1/32 inch). If they are not, loosen the setscrews in the slug rack gear and position the racks properly. Then tighten the setscrews.

(l) Set the 618T-( ) operating frequency to X.600 mc, then back to X.500 mc. Again check to see that the racks are positioned at the same height. If they are not, repeat step (k).

(m) Set the 618T-( ) operating frequency to X.000 mc.

(n) Remove the r-f translator module from its module extender and remove the bottom cover plate from the module. Examine, from the bottom of the module, the slugs and capacitor driven by the slug rack. The bottom of the slugs and capacitor should be the following distances from the bottoms of the coil and capacitor forms.

L6	1/4 inch	C139	1/8 inch
L37	1/4 inch	L59	11/32 inch
L40	1/4 inch		

If these dimensions are not correct, make adjustments from the top of the module to correct them. Use the no. 8 Bristo wrench supplied in Maintenance Kit 678Y-1.

NOTE: If any of the preceding mechanical alignments are made in the r-f translator module, repeat the electrical alignment procedures in steps (a) through (i) of this procedure.

(7) Band-Pass I-F Alignment.

NOTE: Before performing this procedure, perform the variable/band-pass i-f alignment check to determine if the following alignment procedure is required.

(a) Ground J3.

(b) Connect the 410B vtvm a-c probe to J2.

(c) Set the 618T-( ) operating frequency to 6.500 mc.

(d) Key the 618T-( ). Adjust the signal generator output level for 0.5 volt rms at J2.

NOTE: Keep the voltage at J2 constant while making the following adjustments by varying the signal generator output level.

(e) Adjust first L123, then L128, to peak the voltage at J2. These adjustments are made through holes in the module end plate nearest filter FL1.

NOTE: At this point, repeat the variable/band-pass i-f alignment check. If this check still indicates that the band-pass i-f filter is not aligned properly, continue with this procedure.

(f) Replace the 17.5-mc oscillator tube, V10, with a 6AH6WA with pin 1 cut off.

(g) Connect tube V2 to the r-f translator module chassis through the 9-pin tube extender supplied in Maintenance Kit 678Y-1.

(h) Connect the 606A signal generator output, through the 80-ZH3 attenuator, to pin 2 of V2. Tune the signal generator to 15.000 mc.

(i) Connect the 410B vtvm a-c probe to pin 1 of 6 of V2.

(j) Set the 618T-( ) operating frequency to 6.500 mc.

(k) Key the 618T-( ). Adjust the signal generator output level until the 410B vtvm indicates about 0.5 volt rms.

NOTE: The following test points and adjustments are accessible through the r-f translator end plate nearest filter FL1. Refer to the silk screen near the adjustment holes for the location of specific test points and adjustments.

(l) Ground test point 1.

(m) Adjust L123 to peak the 410B vtvm indication.

(n) Unground test point 1. Ground test point 2.

(o) Adjust L125 to null the 410B vtvm indication.

(p) Unground test point 2. Ground test point 3.

R-F Translator Module, Checks and Adjustments (Sheet 2 of 3)
Figure 709

(q) Adjust L126 to peak the 410B vtvm indication.

(r) Unground test point 3. Ground test point 4.

(s) Adjust L127 to null the 410B vtvm indication.

(t) Unground test point 4.

(u) Adjust L128 to peak the 410B vtvm indication.

(v) Disconnect the signal generator from V2. Replace the good V10.

(w) Repeat the variable/band-pass i-f alignment check.

(8) R-F Circuits Alignment.

(a) Remove the turret cover plate.

(b) Set the 618T-( ) operating frequency to 2.XXX mc.

(c) Check the turrets (S1 through S7) from the top of the module to see that the turret contacts in line with the color-code dots on the turrets are making contact with the fixed contacts on the module chassis. If they are not, loosen the clamp on the turret shaft gear, insert a screwdriver into the slot in the end of the turret shaft, and rotate the turrets counterclockwise until they are aligned properly. Then tighten the clamp on the turret shaft gear.

(d) Set the 618T-( ) operating frequency to 3.XXX mc, then back to 2.XXX mc. If the turret contacts do not return to the proper alignment position, repeat step (c).

(e) Couple the 51S-1 receiver to the r-f translator module r-f output by placing the receiver antenna lead wire near driver tubes V6 and V7. Observe the receiver S-meter peaking indication to determine that the r-f adjustments in the following procedure are being made at the proper frequency.

(f) Set the 618T-( ) operating frequency to 29.900 mc.

(g) Key the 618T-( ). Adjust the signal generator output level to give about 30 volts rms at the RF TRANSLATOR LOAD test point.

CAUTION: KEEP THE VOLTAGE AT THE RF TRANSLATOR LOAD TEST POINT BELOW 40 VOLTS RMS WHILE MAKING THE FOLLOWING ADJUSTMENTS. THIS CAN BE DONE BY REDUCING THE SIGNAL GENERATOR OUTPUT LEVEL.

(h) Adjust C27, C65, and C103 to peak the voltage at the RF TRANSLATOR LOAD test point.

(i) Set the 618T-( ) operating frequency to 29.000 mc.

(j) Adjust the 29-mc MIXER PLATE, RF AMP GRID, and RF AMP PLATE coils in the turrets to peak the voltage at the RF TRANSLATOR LOAD test point.

(k) Repeat steps (g) through (k) until no further improvement can be noted.

(l) Set the 618T-( ) operating frequency to 2.900 mc.

(m) Adjust L7, L38, and L42 to peak the voltage at the RF TRANSLATOR LOAD test point.

(n) Set the 618T-( ) operating frequency to 2.000 mc.

(o) Adjust the 2-mc MIXER PLATE, RF AMP GRID, and RF AMP PLATE coils in the turrets to peak the voltage at the RF TRANSLATOR LOAD test point.

(p) Repeat steps (l) through (o) until no further improvement can be noted.

(q) Replace the turret cover plate.

(r) Set the 618T-( ) operating frequency to 2.000 mc, 3.000 mc, 4.000 mc, etc., through 29.000 mc. At each frequency, adjust the MIXER PLATE, RF AMP GRID, RF AMP PLATE, and DRIVE PLATE coils, through the holes in the turret cover plate, to peak the voltage at the RF TRANSLATOR LOAD test point.

(9) Neutralization Adjustments.

NOTE: This procedure need be performed only if either or both of the driver tubes, V6 and V7 are replaced.

(a) Disconnect the 606A signal generator from the module input at J34 on the module extender. Do not make any other connections to J34.

(b) Reverse the RF TRANSLATOR LOAD connections to P2 and P3 so that the blue test point on the load is on the same side as P3. Connect the 606A signal generator output, through the 80-ZH3 attenuator, to the coaxial connector next to the test point on the RF TRANSLATOR LOAD.

(c) Connect the leads of the NEUTRALIZING DETECTOR, supplied in Maintenance Kit 678Y-1 to pins 1 and 2 of tube V6 or V7. Use the 9-pin tube extender, also supplied in the 678Y-1, to make these connections. Connect the 630-NA vom to the NEUTRALIZING DETECTOR output. Set the vom to the 60-ua, d-c scale.

(d) Replace the h-f and 17.5-mc oscillator tubes, V11 and V12, with 6AH6WA's with pin 1 cut off.

(e) Ground J3.

(f) Set the 618T-( ) operating frequency to 28.000 mc.

(g) Set the signal generator output to 28.000 mc, 3 volts. Tune the signal generator slightly around 28.000 mc to peak the vom indication.

NOTE: If the circuit is neutralized, there will not be a noticeable peak.

(h) Adjust C128 to null the vom indication.

(i) Leaving the signal generator connected to the RF TRANSLATOR LOAD, reverse the load connections to P2 and P3 so that the blue test point is again on the same side as P2.

(j) Ground the RF TRANSLATOR LOAD test point.

(k) Set the feedback switch, S15, to ON (clockwise).

(l) Key the 618T-( ). Adjust C127 to null the vom indication. When making this adjustment, the signal generator output should still be set to 28.000 mc, 3 volts.

(m) Disconnect the signal generator and NEUTRALIZING DETECTOR. Replace V11 and V12 with good tubes. Unground J3.

(10) H-F Mixer Balance Adjustment.

(a) Disconnect any connections to the module input at J34 on the module extender.

(b) Set the 618T-( ) operating frequency to 29.900 mc.

(c) Adjust C256 to null the voltage at the RF TRANSLATOR LOAD test point. The voltage at the null should be less than 1.0 volt rms.

(11) Receive/Transmit Gain Balance Check.

NOTE: Leave the r-f translator module connected to the 618T-( ) chassis while performing this procedure. Remove the r-f translator module top cover plate.

(a) Connect the white jack on the 678Z-1 labeled J2-IF TRANS to J2 in the i-f translator module.

(b) Connect the red jack on the 678Z-1 labeled J2-FREQ DIV to J2 in the frequency divider module.

(c) Connect the black jack on the 678Z-1 labeled GRND to the 618T-( ) chassis.

(d) Set the 678Z-1 FUNCTION SELECTOR switch to TGC OVERIDE. Set the 678Z-1 TGC & CAPTURE RANGE control, R3, fully counterclockwise.

(e) Set the 618T-( ) to 29.000 mc, AM.

(f) Key the 618T-( ). Turn the 678Z-1 TGC & CAPTURE RANGE control, R3, clockwise until the 618T-( ) r-f output voltage is about 30 volts rms.

(g) Adjust the RF AM PLATE coil to peak the 618T-( ) r-f output voltage.

(h) Unkey the 618T-( ). Set the 714E-( ) RF SENS control fully clockwise. Set the AUDIO control, R10 under the 618T-( ) front panel cover, fully clockwise.

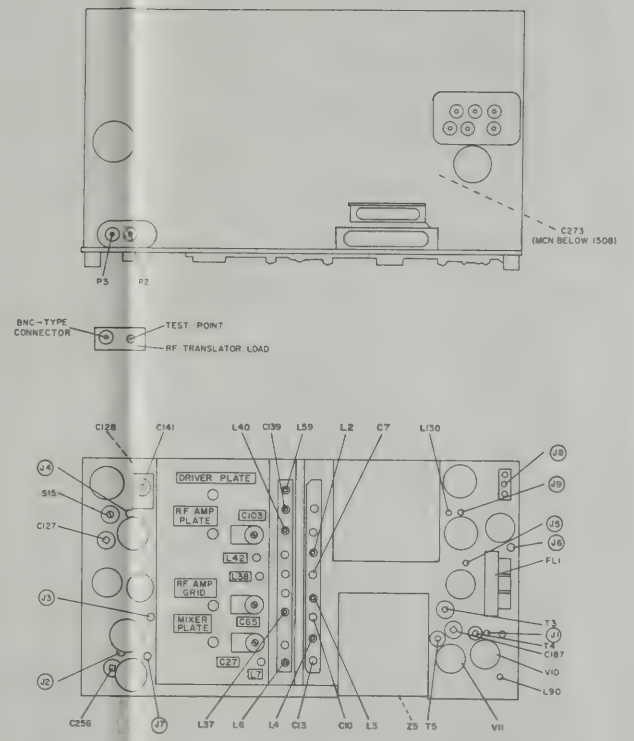
(i) Connect the 606A signal generator output, through the 80-ZH3 attenuator, to the AUX RVCR ANT. connector at the left front of the 618T-( ). Set the signal generator output to 29.000 mc, 30 percent modulated with 1000 cps.

(j) Tune the signal generator slightly around 29.000 mc to peak the voltage at the 678P-1 HEADSET jack. Adjust the signal generator output level for 3.0 volts rms at the HEADSET jack.

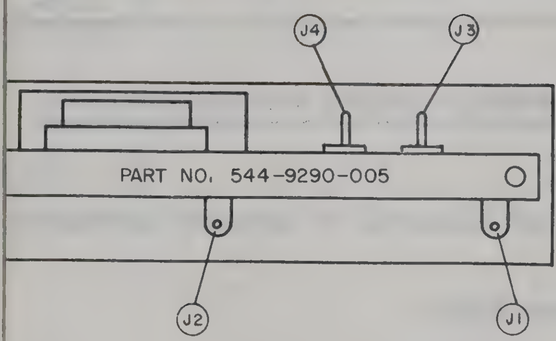
(k) Readjust the RF AMP PLATE coil to peak the voltage at the HEADSET jack. If this adjustment causes the voltage at the HEADSET jack to exceed 3.8 volts rms, replace C61 with a value of capacitance that will keep the voltage at the HEADSET jack within the proper limits. C61 is located in the driver compartment, and is accessible from the bottom of the module.

(l) If C61 is replaced, repeat this procedure.

NOTE: After performing this procedure, readjust the AUDIO control, R10 under the 618T-( ) front panel cover, as instructed in the unit adjustments.



R-F Translator Module, Checks and Adjustments (Sheet 3 of 3)
Figure 709



Electronic Control Amplifier Module Checks
Figure 711

1. POWER AMPLIFIER MODULE TEST POINT DATA.

TEST POINT	QUANTITY BEING TESTED	TEST CONDITIONS	NORMAL INDICATION
J1	Power amplifier grid voltage	AM transmit	-55 to -85 volts
J2	Tgc reference voltage	AM transmit	-5 to -7 volts
J3	Power amplifier screen voltage	AM transmit	+360 to +440 volts
J4	Bias supply voltage	AM transmit	Approximately 1.5 volts d-c less than at J1
J5	Adc voltage	AM transmit	-4.75 volts

2. POWER AMPLIFIER MODULE CHECKS AND ADJUSTMENTS.

A. Test Equipment.

The following test equipment, or equivalent, is required to check and adjust the power amplifier module.

(1) Test Harness 678P-1.

(2) Maintenance Kit 678Y-1.

(3) Function Test Set 678Z-1.

(4) HP-410B vtvm.

(5) Bird 82C dummy load.

B. Equipment Setup.

Leave the power amplifier module and all other modules connected to the 618T-( ) chassis.

C. Procedure.

(1) Static Plate Current Adjustment.

Refer to the unit adjustments, paragraph 5, for this adjustment.

(2) TGC Adjustment.

Refer to the unit adjustments, paragraph 5, for this adjustment.

(3) ADC Adjustment.

(a) Set the 618T-( ) to AM, 2.900 mc.

(b) Remove the plug at the upper left of the power amplifier module.

(c) Connect the 410B vtvm d-c probe to J5.

(d) Key the 618T-( ). Adjust R20 to give -4.75 volts at J5.

CAUTION: MAKE THIS ADJUSTMENT QUICKLY TO AVOID DAMAGE TO THE MODULE DUE TO LACK OF COOLING AIR. REPLACE THE PLUG AS SOON AS THE ADJUSTMENT IS MADE.

(4) PEP Limiter Adjustment.

(a) Connect the white jack on the 678Z-1 labeled J2-IF TRANS to J2 in the i-f translator module.

(b) Connect the red jack on the 678Z-1 labeled J2-FREQ DIV to J2 in the frequency divider module.

(c) Connect the black jack on the 678Z-1 labeled GRND to the 618T-( ) chassis.

(d) Set the 678Z-1 TGC & CAPTURE RANGE control, R3, fully counterclockwise.

(e) Set the 678Z-1 FUNCTION SELECTOR switch to TGC OVERIDE.

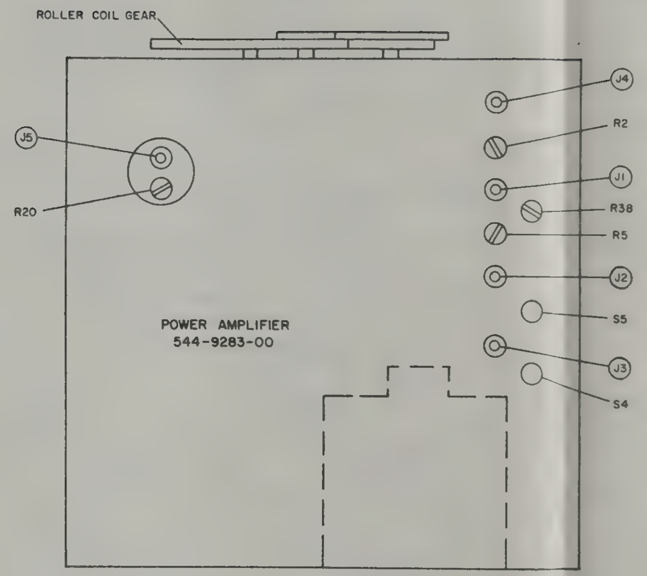
(f) Set the 618T-( ) operating frequency to 7.300 mc, USB.

(g) Connect the 630-NA vom between J1(+) and J4(-). The voltage between these two points should be about 1.5 volts d-c.

(h) Set the outputs of the two 200AB audio oscillators to 900 cps, 0.1 volt rms, and 2800 cps, 0.1 volt rms. Check the audio oscillators' output levels at the 678Z-1 TEST POINT with the 310A vtvm.

(i) Turn the 678Z-1 TGC & CAPTURE RANGE control, R3, clockwise until the d-c voltage between J1 and J4 just begins to decrease. Note the 618T-( ) r-f output voltage at this point. It should be 161 volts rms maximum. If it is greater than 161 volts rms, adjust R38 to limit the maximum r-f output voltage to 161 volts rms.

CAUTION: DO NOT KEEP THE 618T-( ) R-F OUTPUT VOLTAGE AT ITS MAXIMUM VALUE ANY LONGER THAN NECESSARY TO NOTE THE MAXIMUM INDICATION. SET THE 678Z-1 TGC & CAPTURE RANGE CONTROL FULLY COUNTERCLOCKWISE AFTER NOTING THIS VOLTAGE.



Power Amplifier Module, Checks and Adjustments
Figure 710

1. ELECTRONIC CONTROL AMPLIFIER MODULE TEST POINT DATA.

TEST POINT	QUANTITY BEING TESTED	TEST CONDITIONS	NORMAL INDICATION
J1	Q1 output/Q2 input voltage	Power on	+6.4
J2	Q4 output voltage	Power on	+5.6
J3 J4	Amplifier output	Power on	+0.15

2. ELECTRONIC CONTROL AMPLIFIER MODULE CHECKS.

A. Test Equipment.

The following test equipment, or equivalent, is required to check the electronic control amplifier module.

(1) Test Harness 678P-1.

(2) Maintenance Kit 678Y-1.

(3) HP-410B vtvm.

(4) Ballantine 310A vtvm.

B. Equipment Setup.

Connect the 618T-( ) and test equipment as shown in figure 701. Connect the electronic control amplifier module to the 618T-( ) chassis through the module extender supplied in the 678Y-1. Leave all other modules in place on the chassis. Remove the electronic control amplifier module dust cover.

C. Procedure.

(1) Amplifier Gain Check.

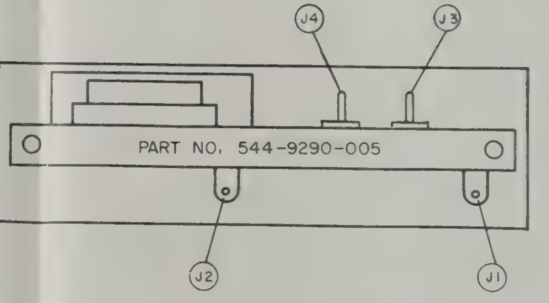
(a) Set the 618T-( ) to AM, any frequency.

(b) Connect the 410B vtvm d-c probe to TP9 on the module extender.

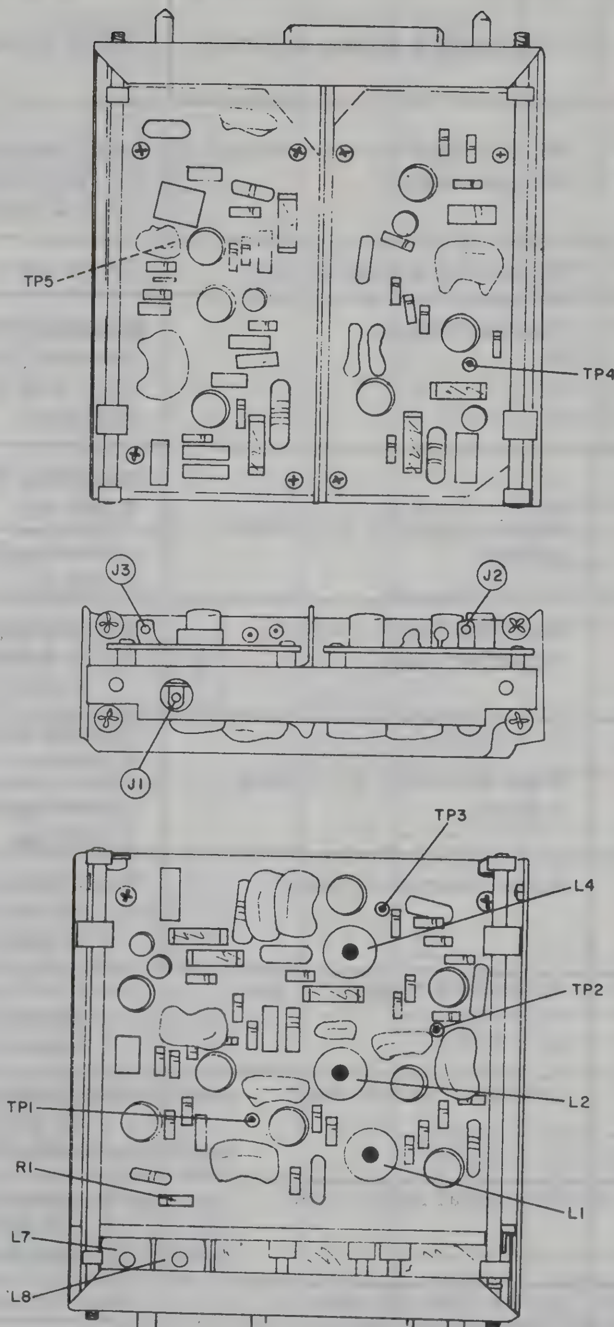
(c) Connect the 310A vtvm between J3 and J4.

(d) Key the 618T-( ). Rotate the large roller coil gear on the top of the power amplifier module in either direction until the amplifier input voltage at TP5 is ±0.2 volt.

(e) Note the amplifier output voltage between J3 and J4. It should be between 18 and 30 volts rms. If it is not, perform a stage-by-stage check of the amplifier to isolate the faulty stage.



Electronic Control Amplifier Module Checks
Figure 711



Frequency Divider Module, Checks and Adjustments
Figure 713

1. R-F OSCILLATOR MODULE TEST POINT DATA.

TEST POINT	QUANTITY BEING TESTED	TEST CONDITIONS	NORMAL INDICATION
J1	100-kc reference output to frequency divider	Power on	0.4 volt rms min
J2	Transistor supply voltage	Power on	+16 volts
J3	500-kc reference output to megacycle-frequency stabilizer	Power on	1.1 ±0.1 volts rms
J4	500-kc carrrier output to balanced modulator	Power on	1.7 ±0.1 volts rms

2. R-F OSCILLATOR MODULE CHECKS AND ADJUSTMENTS.

A. Test Equipment.

The following test equipment, or equivalent, is required to check and adjust the r-f oscillator module.

(1) Test Harness 678P-1.

(2) Maintenance Kit 678Y-1.

(3) HP-410B vtvm.

(4) HP-606A signal generator with 80-ZH3 attenuator.

(5) Boonton 91-C vtvm.

(6) Tektronix 541 oscilloscope.

(7) HP-524D frequency counter.

B. Equipment Setup.

Connect the 618T-( ) and test equipment as shown in figure 701. Connect the r-f oscillator module to the 618T-( ) chassis through the module extender supplied in the 678Y-1. Leave all other modules in place on the chassis. Remove the r-f oscillator module dust cover.

C. Procedure.

(1) Reference Oscillator Frequency Adjustment.

NOTE: The r-f oscillator module ambient temperature should be between +25°C and +30°C while making this adjustment.

(a) Connect a receive antenna to the AUX RCVR ANT. connector at the left front of the 618T-( ). The antenna should be located in a low-noise area.

(b) Set the 618T-( ) to USB.

(c) Set the 618T-( ) operating frequency 1 kc below the frequency of WWV.

NOTE: WWV transmits on 2.500 mc, 5.000 mc, 10.000 mc, 15.000 mc, 20.000 mc, and 25.000 mc. Select a frequency that gives a good signal with little fading.

(d) Connect the 541 oscilloscope to the 678P-1 HEADSET jack.

(e) At a time when WWV is not transmitting a tone, observe the 1000-cps signal on the oscilloscope. This signal represents the carrier of WWV.

(f) Hold the 618T-( ) front panel meter selector switch in the CAL TONE position. This connects a 1000-cps reference output from the frequency divider module to the audio output.

(g) Adjust the 714E-( ) RF SENS control until both 1000-cps signals observed on the oscilloscope are approximately the same amplitude.

(h) Adjust the FREQUENCY ADJUST control for 0 phase drift between the two 1000-cps signals.

(2) Reference Oscillator Board Check.

(a) Check for +18 volts at the +18-volt test point.

(b) Check for 3 mc, 0.4 to 0.6 volt rms at the reference oscillator output test point.

(c) If the +18 volts is present, but the 3-mc signal amplitude is improper, return the oscillator board to Collins for repair. Unsolder one coaxial cable and two wires from the bottom of the board in order to remove it from the module.

(3) Divider Bandwidth and Output Check.

(a) Unsolder the coaxial cable from point 1. Connect the 606A signal generator output, through the 80-ZH3 attenuator and a 1000-pf capacitor, to point 1. Set the generator output to 3 mc, 0.5 volt rms.

(b) Connect the oscilloscope vertical input to point 1. Connect the horizontal input to J3.

(c) While observing the 6-to-1 Lissajous pattern on the oscilloscope, tune the signal generator from 2.9 mc to 3.1 mc. The Lissajous pattern should remain stable (not fuzzy) as the generator is tuned across this range. If it does not remain stable replace C14 with a value of capacitance that will give the proper indication.

(d) Set the signal generator output to 3.0 mc, 0.5 volt rms. Connect the 91-C vtvm to J3. The voltage at J3 should be 1.1 ±0.1 volts rms. If it is not, select a value for C20 that peaks the voltage at J3, then select a value of R44 that gives the proper voltage at J3.

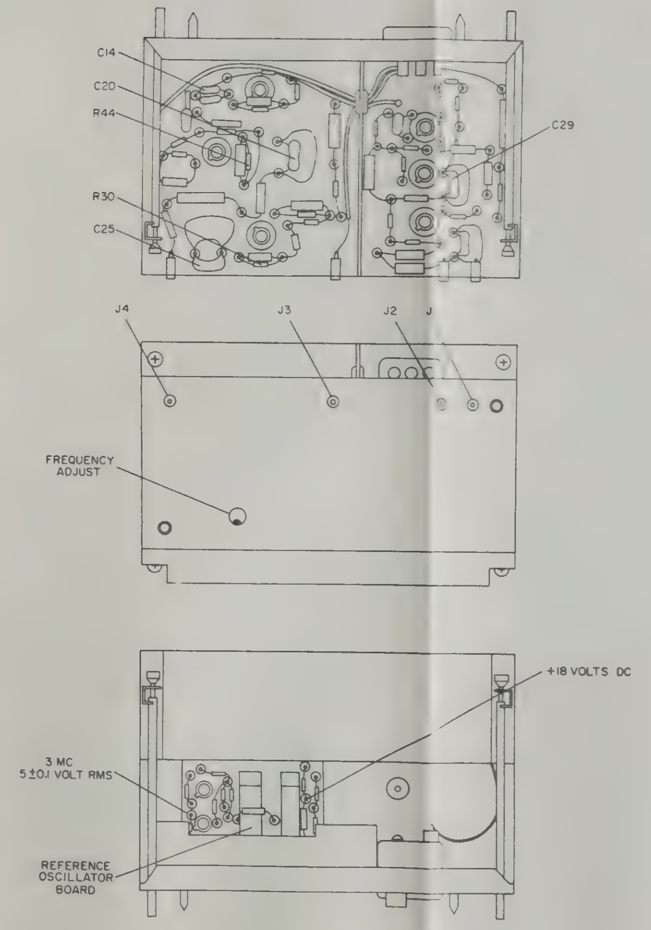
(e) Connect the 91-C vtvm to J4. The voltage at J4 should be 1.7 ±0.2 volts rms. If it is not, select a value for C25 that peaks the voltage at J4, then select a value for R30 that gives the proper voltage at J4.

(f) Unsolder the coaxial cable from point 2. Connect the signal generator output, through the 80-ZH3 attenuator and a 1000-pf capacitor, to point 2. Set the generator output to 500 kc, 0.5 volt rms.

(g) Connect the oscilloscope vertical input to point 2. Connect the horizontal input to J1.

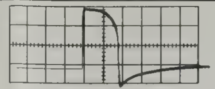
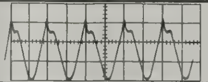
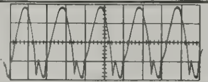
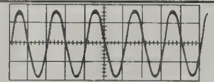
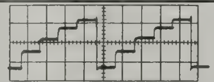
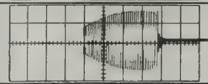
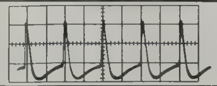
(h) While observing the 5-to-1 Lissajous pattern on the oscilloscope, tune the signal generator from 485 kc to 515 kc. The Lissajous pattern should remain stable (not fuzzy) as the generator is tuned across this range. If it does not remain stable, replace C29 with a value of capacitance that will give the proper indication.

(i) Resolder the coaxial cables to points 1 and 2.



R-F Oscillator Module, Checks and Adjustments
Figure 712

1. FREQUENCY DIVIDER MODULE TEST POINT DATA.

TEST POINT	QUANTITY BEING TESTED	TEST CONDITIONS	NORMAL INDICATION
J1	10-kc reference pulse output	Oscilloscope set for: 2 volts/cm 1 usec/cm	
J2	Transistor supply voltage	Power on	+18 volts
J3	Keyer output	Oscilloscope set for: 5 volts/cm 200 usec/cm	
TP1	50-kc locked oscillator output	Oscilloscope set for: 0.5 volt/cm 10 usec/cm	
TP2	10-kc locked oscillator output	Oscilloscope set for: 0.5 volt/cm 50 usec/cm	
TP3	5-kc locked oscillator output	Oscilloscope set for: 1.5 volts/cm 100 usec/cm	
TP4	1-kc unijunction divider output	Oscilloscope set for: 0.5 volts/cm (d-c) 200 usec/cm	
TP5	Keyed oscillator output	Oscilloscope set for: 2 volts/cm 25 usec/cm	
TP6 (module extender)	1-kc cal tone output	Oscilloscope set for: 0.5 volt/cm 500 usec/cm	

2. FREQUENCY DIVIDER MODULE CHECKS AND ADJUSTMENTS.

A. Test Equipment.

The following test equipment, or equivalent, is required to check and adjust the frequency divider module.

(1) Test Harness 678P-1.

(2) Maintenance Kit 678Y-1.

(3) HP-410B vtvm.

(4) HP-606A signal generator with 80-ZH3 attenuator.

(5) Tektronix 541 oscilloscope.

B. Equipment Setup.

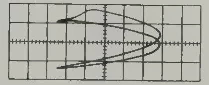
Connect the 618T-( ) and test equipment as shown in figure 701. Connect the frequency divider module to the 618T-( ) chassis through the module extender supplied in the 678Y-1. Leave all other modules in place on the chassis. Remove the frequency divider module dust cover.

C. Procedure.

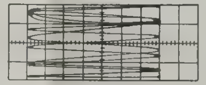
(1) Divider Bandwidth Adjustment.

(a) Disconnect the coaxial jumper at A2 on the module extender. Connect the 606A signal generator output, through the 80-ZH3 attenuator, to the module input at A2 on the module extender. Also connect the signal generator output to the oscilloscope horizontal input. Set the signal generator output to 100 kc, 0.5 volt.

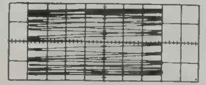
(b) Connect the oscilloscope vertical input to TP1, TP2, and TP3 in that order. Check the bandwidth at each of these three points as follows. Observe the Lissajous pattern on the oscilloscope (see below) while tuning the signal generator on both sides of 100 kc until the Lissajous pattern becomes unstable (fuzzy). The frequency at which this occurs is the edge of the band. The bandwidth at all three test points should be centered at 100 ±1 kc and should extend at least 4 kc on both sides of the center frequency. Bandwidths at TP1, TP2, and TP3 can be centered by adjusting L1, L2, and L4 respectively.



TP1
2-to-1 Lissajous



TP2
10-to-1 Lissajous



TP3
20-to-1 Lissajous

(c) Disconnect the signal generator. Replace the coaxial jumper on the module extender.

(2) Keyed Oscillator Output Adjustment.

(a) Connect the kilocycle-frequency stabilizer module to the 618T-( ) chassis through the module extender supplied in the 678Y-1.

(b) Set the 618T-( ) operating frequency to X.XX0 mc.

(c) Connect the 541 oscilloscope to J8 in the kilocycle-frequency stabilizer module.

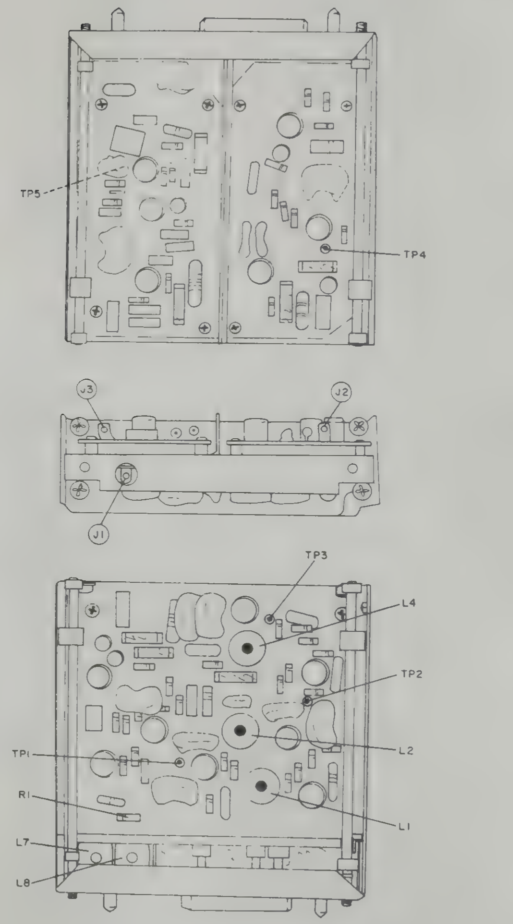
(d) Adjust L7 and L8 to peak the signal amplitude at J8 in the kilocycle-frequency stabilizer module.

(3) Calibration Tone Output Level Check.

Observe the waveform at TP6. It should be as shown in the test point data chart. The pulse amplitude should be from 1.0 to 1.5 volts peak-to-peak. If it is not, replace R48 with a value of resistance that will give the proper indication.

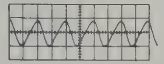
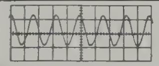
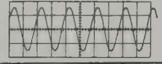
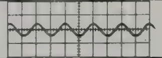
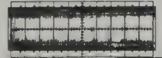
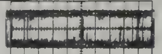
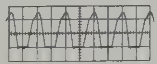
(4) Unijunction Divider Output Check.

Observe the waveform at TP4. It should be as shown in the test point data chart. The firing voltage should be at +0.45 volt above the 5th step. If it is not, replace C22 and C45 with values of capacitance that will give the proper indication.



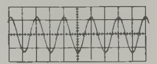
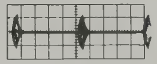
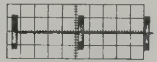
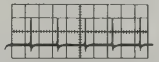
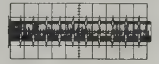
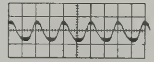
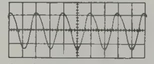
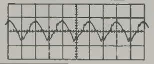
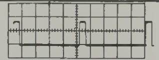
Frequency Divider Module, Checks and Adjustments
Figure 713

1. KILOCYCLE-FREQUENCY STABILIZER MODULE TEST POINT DATA.

TEST POINT	QUANTITY BEING TESTED	TEST CONDITIONS	NORMAL INDICATION
J1	Vfo r-f input/vfo d-c tuning voltage output	Oscilloscope set for: 0.5 volt/cm 0.2 usec/cm	
J2	Transistor supply voltage	Power on	+18 volts
J3	Vfo bias voltage	Measure bias voltage between J3(+) and J1(-) with TP5 grounded	±10.00 ±0.01 volts
J4	Keyed oscillator d-c tuning voltage	Operating frequency= X.000 mc	+20.00 ±0.2 volts
		Operating frequency = X.999 mc	Approx +4 volts
J5	Digit oscillator isolation amplifier output	Oscilloscope set for: 2 volts/cm 2 usec/cm	
J6	Digit oscillator d-c tuning voltage	Operating frequency = X.XX5 mc	Approx +23 volts
		Operating frequency = X.XX6 mc	Approx +7 volts
J7	Signal channel i-f input	Oscilloscope set for: 50 mv/cm 2 usec/cm	
J8	Reference channel i-f input	Oscilloscope set for: 50 mv/cm 2 usec/cm	
TP1	1st signal mixer input	Oscilloscope set for: 50 mv/cm 100 usec/cm	
TP2	2nd signal mixer input	Oscilloscope set for: 100 mv/cm 100 usec/cm	
TP3	FL1 output/Q5 input	Used for adjustment only	
TP4	Q6 output/Q7 input	Oscilloscope set for: 1 volt/cm 2 usec/cm	

Kilocycle-Frequency Stabilizer Module, Checks and Adjustments (Sheet 1 of 2)
Figure 714

1. KILOCYCLE-FREQUENCY STABILIZER MODULE TEST POINT DATA. (Cont)

TEST POINT	QUANTITY BEING TESTED	TEST CONDITIONS	NORMAL INDICATION
TP5	Q8 output/signal input to phase discriminator	Oscilloscope set for: 5 volts/cm 2 usec/cm	
TP6	Omitted	--	--
TP7	Frequency discriminator d-c output	250,000 ±5 cps, 40 mv at J7, TP15 grounded	0 +5 mv d-c
TP8	Spectrum generator output	Oscilloscope set for: 50 mv/cm 20 usec/cm	
TP9	Keyer/keyed oscillator supply voltage	Power on	+18 volts
TP10	Keyed oscillator output	Oscilloscope set for: 2 volts/cm 20 usec/cm	
TP11	10-kc pulse input from frequency divider module	Oscilloscope set for: 100 mv/cm 1 ms/cm	
TP12	Reference mixer input	Oscilloscope set for: 100 mv/cm 1 mc/cm	
TP13	FL2 output/Q16 input	Used for adjustment only	
TP14	Q17 output/Q18 input	Oscilloscope set for: 50 mv/cm 2 usec/cm	
TP15	Q19 output/reference input to phase discriminator	Oscilloscope set for: 1 volt/cm 2 usec/cm	
TP16	Signal input to phase discriminator	Oscilloscope set for: 5 volts/cm 2 usec/cm	
TP17 TP18	Phase discriminator d-c output	TP5 and TP15 grounded	0 ±5 mv d-c
TP19	Keyer output	Oscilloscope set for: 5 volts/cm 20 usec/cm	

2. KILOCYCLE-FREQUENCY STABILIZER MODULE CHECKS AND ADJUSTMENTS.

A. Test Equipment.

The following test equipment, or equivalent, is required to check and adjust the kilocycle-frequency stabilizer module.

(1) Test Harness 678P-1.

(2) Maintenance Kit 678Y-1.

(3) Function Test Set 678Z-1.

(4) HP-410B vtvm.

(5) HP-606A signal generator with 80-ZH3 attenuator.

(6) Tektronix 541 oscilloscope.

(7) HP-524D frequency counter.

(8) Temperature box (range from -50°C to +80°C).

B. Equipment Setup.

Connect the 618T-( ) and test equipment as shown in figure 701. Connect the kilocycle-frequency stabilizer module to the 618T-( ) chassis through the module extender supplied in the 678Y-1. Leave all other modules in place on the chassis. Remove the kilocycle-frequency stabilizer module dust cover.

C. Procedure.

(1) VFO Bias Adjustment.

(a) Connect the brown jack on the 678Z-1 labeled J1-KC STAB to J1.

(b) Connect the orange jack on the 678Z-1 labeled J3-KC STAB to J3.

(c) Connect the black jack on the 678Z-1 labeled GRND to the 618T-( ) chassis.

(d) Ground TP5.

(e) Set the 678Z-1 FUNCTION SELECTOR switch to SET LEVEL. Adjust the LEVEL SET control, R1, until the FUNCTION METER indicates +10. Do not use the X10 METER SENSITIVITY switch.

(f) Set the 678Z-1 FUNCTION SELECTOR switch to OFF-SET ADJUST. Adjust the OFF-SET ADJUST control, R2, until the FUNCTION METER indicates 0 when the X10 METER SENSITIVITY switch is operated several times.

(g) Set the 678Z-1 FUNCTION SELECTOR switch to 70K-5 VFO BIAS. The FUNCTION METER should indicate 0 when the X10 METER SENSITIVITY switch is operated several times. If it does not, adjust R62 for the proper indication.

(h) Unground TP5.

(i) Disconnect the test leads from J1 and J3.

NOTE: The preceding procedure applies only to kilocycle-frequency stabilizer modules with Collins part number 528-0112-005. If the module part number is 544-9288-005, make the following changes in the above procedure:

1. Omit steps (b), (f).

2. Change switch setting in step (g) from 70K-5 VFO BIAS to 70K-3 VFO BIAS.

(2) Keyed Oscillator Adjustment.

(a) Connect the yellow jack on the 678Z-1 labeled J4-KC STAB to J4.

(b) Connect the black jack on the 678Z-1 labeled GRND to the 618T-( ) chassis.

(c) Set the 678Z-1 FUNCTION SELECTOR switch to SET LEVEL. Adjust the LEVEL SET control, R1, until the FUNCTION METER indicates +10. Do not use the X10 METER SENSITIVITY switch.

(d) Set the 618T-( ) operating frequency to X.000 mc.

(e) Set the 678Z-1 FUNCTION SELECTOR switch to 10KC CONTROL BIAS (+20V). The FUNCTION METER should indicate 0 when the X10 METER SENSITIVITY switch is operated several times. If it does not, adjust R63 for the proper indication.

(f) Disconnect the test lead from J4. Connect the 410B vtvm d-c probe to J4.

(g) Reset the 618T-( ) operating frequency to X.111 mc, X.222 mc, etc., through X.999 mc. The voltage at J4 should decrease in continuous steps from +20 volts at X.000 mc to about +4 volts at X.999 mc. If it does not, check resistors R1 through R21 and switches S3 and S4 in the Autopositioner.

(h) Connect the 541 oscilloscope to J7.

(i) Set the 618T-( ) operating frequency to X.000 mc.

(j) Adjust C54 and C55 to peak the voltage at J7.

(k) Set the 618T-( ) operating frequency to X.999 mc.

(l) Adjust T2-P and T2-S to peak the voltage at J7.

(3) Digit Oscillator Adjustment.

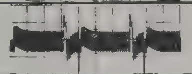
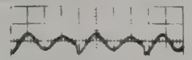
(a) Connect the 410B vtvm d-c probe to J6.

(b) Set the 618T-( ) operating frequency to X.XX5 mc, X.XX4 mc, etc., through X.XX6 mc. The voltage at J6 should decrease in continuous steps from about +23 volts at X.XX5 mc to about +6 volts at X.XX6 mc. If it does not, check resistors R22 through R32 and switch S6 in the Autopositioner.

(c) Connect the frequency counter to J5. Use the red test probe with BNC-type connector supplied in the 678Y-1. Drive the frequency counter through the oscilloscope vertical amplifier.

(d) Set the 618T-( ) operating frequency to X.XX6 mc. The counter should indicate 296,000 ±5 cps. If it does not, adjust R59 for the proper indication.

1. MEGACYCLE-FREQUENCY STABILIZER MODULE TEST POINT DATA.

TEST POINT	QUANTITY BEING TESTED	TEST CONDITIONS	NORMAL INDICATION
J1	H-f oscillator d-c tuning voltage output	Power on	+7.0 ±0.5 volts
J2	Transistor supply voltage	Power on	+18 volts
J3	17.5-mc oscillator d-c tuning voltage output	Power on Operating frequency from 2.000 mc to 6.999 mc	+7.0 ±0.5 volts
J4	H-f oscillator r-f input	Power on	80 mv rms minimum
J5	17.5-mc oscillator r-f input	Power on	80 mv rms minimum
TP1	Squaring amplifier output	Oscilloscope set for: 0.5 volt/cm 5 usec/cm	
TP2	Pulse generator output	Oscilloscope set for: 5 volts/cm 5 usec/cm	
TP3	Mixer input	Oscilloscope set for: 0.5 volt/cm 5 usec/cm	
TP4	Mixer output/i-f amplifier input	Oscilloscope set for: 0.5 volt/cm 5 usec/cm	

2. MEGACYCLE-FREQUENCY STABILIZER MODULE CHECKS AND ADJUSTMENTS.

A. Test Equipment.

The following test equipment, or equivalent, is required to check and adjust the megacycle-frequency stabilizer module.

(1) Test Harness 678P-1.

(2) Maintenance Kit 678Y-1.

(3) HP-410B vtvm.

(4) Boonton 91-C vtvm.

(5) HP-606A signal generator with 80-ZH3 attenuator.

(6) Tektronix 541 oscilloscope.

B. Equipment Setup.

Connect the 618T-( ) and test equipment as shown in figure 701. Connect the megacycle-frequency stabilizer module to the 618T-( ) chassis through the module extender supplied in the 678Y-1. Leave all other modules in place on the chassis. Remove the megacycle-frequency stabilizer module dust cover.

C. Procedure.

(1) Reference Spectrum Level Adjustment.

(a) Ground J4 and J5.

(b) Connect the 410B vtvm d-c probe to J1. The voltage at this point should be +6.5 ±0.5 volts. If it is not, adjust R6 for the proper voltage at J1.

(c) Connect the 410B vtvm d-c probe to J3. The voltage at this point should be +6.5 ±0.5 volts. If it is not, adjust R5 for the proper voltage at J3.

(d) Recheck the voltage at J1 to be sure it is as specified in step (b). If necessary, readjust R6 and R5 until the voltage at both J1 and J3 is +6.5 ±0.5 volts.

(e) Unground J4 and J5.

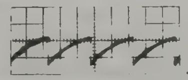
(2) Recycle Check.

(a) Disconnect the two coaxial jumpers on the module extender.

(b) Connect the 606A signal generator, through the 80-ZH3 attenuator, to the module input at A1 on the module extender. Tune the signal generator to 17.503 mc.

(c) Connect the 91-C vtvm to J5. Adjust the signal generator output level for 80 mv rms at J5.

(d) Connect the 541 oscilloscope to J3. Set the oscilloscope for 5 volts/cm, d-c, 5 msec/cm. The waveform at J3 should be as shown below.

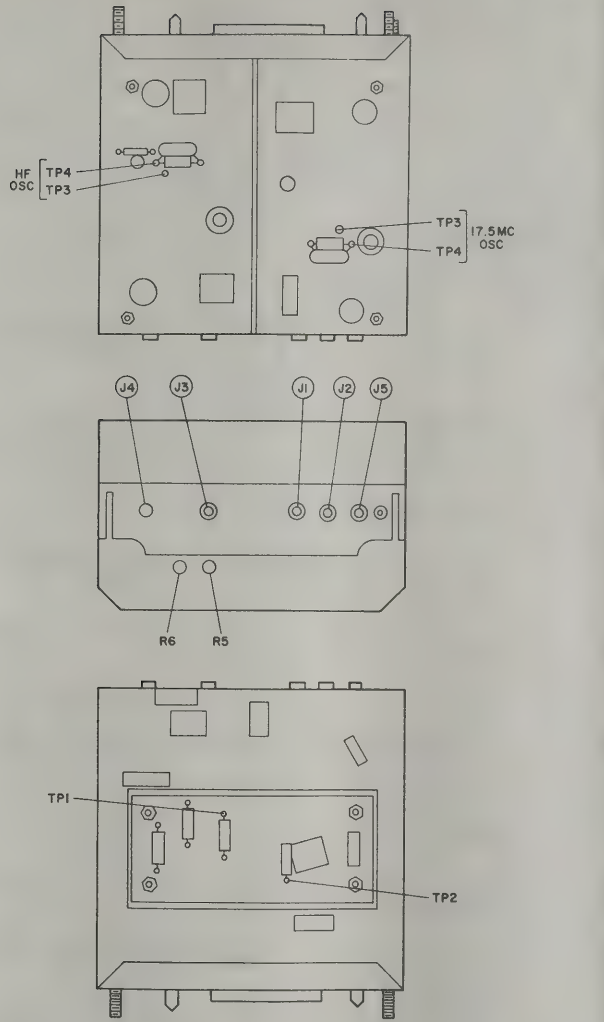


The sawtooth peak value should be +9 to +12 volts, the minimum value should be 0 to +4 volts, and the period should be 5 to 10 msec. If the waveform at J1 is improper, trouble is in recycle stage Q3 or associated components.

(e) Connect the 606A signal generator output, through the 80-ZH3 attenuator, to the module input at A2 on the module extender. Tune the signal generator to 8.003 mc.

(f) Connect the 91-C vtvm to J4. Adjust the signal generator output level for 80 mv rms at J4.

(g) Connect the 54 oscilloscope to J1. Set the oscilloscope for 5 volts/cm, d-c, 5 msec/cm. The waveform at J1 should be the same as the one specified in step (d). If it is not, trouble is in recycle stage Q4 or associated components.



Megacycle-Frequency Stabilizer Module Checks and Adjustments
Figure 715

(e) Set the 618T-( ) operating frequency to X.XX5 mc. The counter should indicate 305,000 ±5 cps. If it does not, adjust L14 for the proper indication.

(f) Reset the 618T-( ) operating frequency to X.XX6 mc. The counter should still indicate 296,000 ±5 cps. If necessary, readjust R59 and L14 until proper frequency indications are obtained at both the X.XX6-mc and X.XX5-mc settings.

(g) Check the digit oscillator frequency at each of the 10 digits. The frequency at each digit setting is listed in the following table. At each setting, the frequency error limit is +20 cps from the listed frequency.

618T-( ) OPERATING FREQUENCY (mc)	DIGIT OSCILLATOR FREQUENCY (cps)
X.XX6	296,000
X.XX7	297,000
X.XX8	298,000
X.XX9	299,000
X.XX0	300,000
X.XX1	301,000
X.XX2	302,000
X.XX3	303,000
X.XX4	304,000
X.XX5	305,000

(h) If the frequency at each digit setting is not within ±20 cps of the frequencies listed in the above table, replace C64 and C125 with values of capacitance that will give the proper frequency at each digit setting. A change of +5 pf will raise the frequency at the X.XX1-mc setting about 10 cps. Leave a minimum capacitance of 20 pf in the circuit.

(i) Connect the kilocycle-frequency stabilizer module to the 618T-( ) chassis with an 18-inch pendant cable. Place the module in the temperature box. Repeat step (h) at module temperatures of -55, -5, +5, +50, and +80°C. If the frequency at each digit setting is not within ±200 cps of the frequencies listed in the above table at all temperatures, replace C64 and C125 with capacitors having the same value of capacitance, but with different temperature coefficients to bring the frequencies within ±200 cps of the listed frequencies over the temperature range from -55°C to +80°C.

(4) Signal Channel Input Adjustment.

(a) Connect the 541 oscilloscope to J7.

(b) Set the 618T-( ) operating frequency to X.XX0 mc.

(c) Adjust L2, L3, C18, and C19 to peak the voltage at J7.

NOTE: Check for two tuning points on each capacitor to be sure they are at resonance.

(5) Signal Channel I-F/Frequency Discriminator Adjustment.

(a) Disconnect the module extender from the 618T-( ) chassis, but leave the module connected to the extender.

(b) Connect a no. 22 wire from pin 2 of chassis connector J12 to TP2 on the module extender. Make no other connections between the 618T-( ) chassis and the module or module extender.

NOTE: Some of the following test points and adjustments are located on circuit board E2. This board is located behind board E6. To make test points and adjustments on E2 accessible, remove E6 and the metal divider between E6 and E2 by removing five screws from E6.

(c) Connect the 541 oscilloscope to TP16.

(d) Connect the 606A signal generator output, through the 80-ZH3 attenuator, to J7. Connect the 524D frequency counter in parallel with the signal generator output to measure the signal generator frequency.

(e) Set the signal generator output to 250,000 ±30 cps, level below that required to saturate the i-f amplifiers.

(f) Adjust L7 and T1 to peak the voltage at TP15. If necessary, reduce the signal generator output level during the peaking procedure to prevent amplifier saturation.

(g) Connect the Fluke 801B d-c vtvm between TP7 and ground.

(h) Adjust L8 for 0 ±5 mv d-c between TP7 and ground.

NOTE: The following steps need be performed only if a component on board E2 has been replaced.

(i) Place the module in the temperature box. Leave the oscilloscope and d-c vtvm connected to the module.

(j) Lower the module temperature to -55°C. Tune the signal generator to produce a null indication on the d-c vtvm. Note the signal generator output frequency. Note the signal level at TP16.

NOTE: Leave the signal generator output level constant while performing the following steps.

(k) Raise the module temperature to +80°C. Tune the signal generator to produce a null indication on the d-c vtvm. Note the signal generator output frequency. Note the signal level at TP16.

(l) If either (or both) of the signal generator frequencies noted in the two preceding steps is more than ±70 cps from 250,000 cps, replace parallel capacitors C37 and C124 with capacitors having the same total capacitance, but with different temperature coefficients that will bring the frequencies within the proper limits at the temperature extremes.

(m) If the signal amplitude at TP16 varies more than 3 db between the temperature extremes, replace parallel capacitors C33 and C123 with capacitors having the same total capacitance, but with different temperature coefficients that will bring the amplitude within the proper limits at the temperature extremes.

(n) Remove the module from the temperature box. Disconnect the oscilloscope and d-c vtvm from the module, and reassemble the module.

(6) Reference Channel Input Adjustment.

(a) Connect the 541 oscilloscope to J8.

(b) Set the 618T-( ) operating frequency to X.XX0 mc.

(c) Adjust L17, C85, and C86 to peak the voltage at J8.

NOTE: Check for two tuning points on each capacitor to be sure they are at resonance.

(d) Set the 618T-( ) operating frequency to X.XX6 mc.

(e) Adjust L8 in the frequency divider module to peak the voltage at J8.

(f) Set the 618T-( ) operating frequency to X.XX1 mc.

(g) Adjust L7 in the frequency divider module to peak the voltage at J8.

(7) Reference Channel I-F Adjustment.

(a) Disconnect the module extender from the 618T-( ) chassis, but leave the module connected to the extender.

(b) Connect a no. 22 wire from pin 8 of chassis connector J12 to TP8 on the module extender. Make no other connections between the 618T-( ) chassis and the module or module extender.

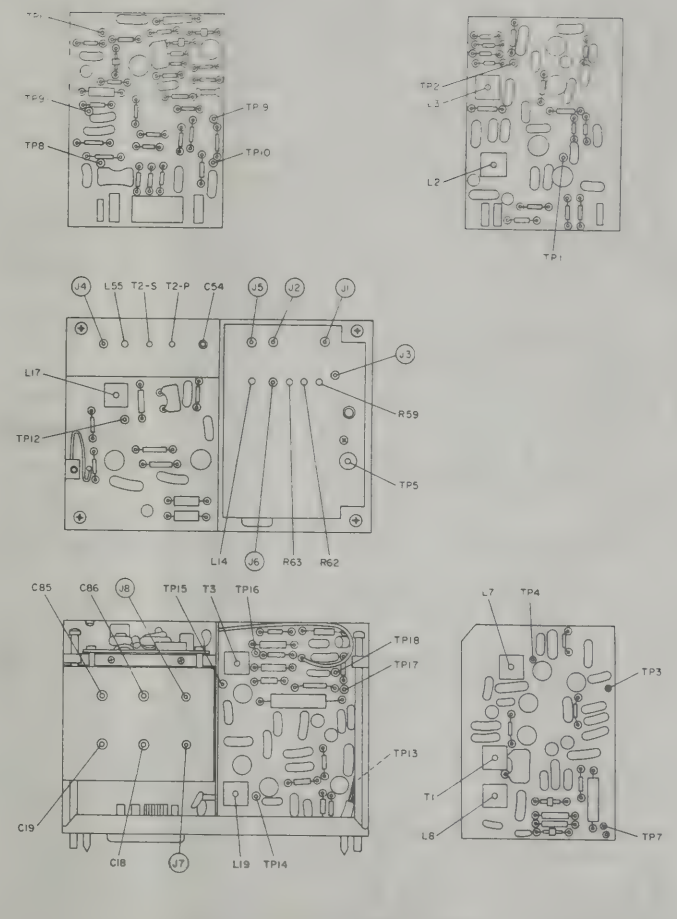
(c) Connect the 541 oscilloscope to TP15.

(d) Connect the 606A signal generator output, through the 80-ZH3 attenuator, to J8. Connect the 524D frequency counter in parallel with the signal generator output to measure the signal generator output frequency.

(e) Set the signal generator output to 250,000 +30 cps, level below that required to saturate the i-f amplifiers.

(f) Adjust L19 and T3 to peak the voltage at TP15. If necessary, reduce the signal generator output level during the peaking procedure to prevent amplifier saturation.

(g) Disconnect the oscilloscope and signal generator from the module.



Kilocycle-Frequency Stabilizer Module, Checks and Adjustments (Sheet 2 of 2)
Figure 714

1. R-F OSCILLATOR MODULE TEST POINT DATA.

TEST POINT	QUANTITY BEING TESTED	TEST CONDITIONS	NORMAL INDICATION
J1	100-kc reference output to frequency divider	Power on	0.4 volt rms min
J2	Transistor supply voltage	Power on	+18 volts
J3	500-kc rference output to megacycle-frequency stabilizer	Power on	1.1 ±0.1 volts rms
J4	500-kc carrier output to balanced modulator	Power on	2.0 volts rms min
J5	Transistor supply voltage	Power on	+18 volts
J6	3-mc reference oscillator output	Power on	Approx 70 mv

2. R-F OSCILLATOR MODULE CHECKS AND ADJUSTMENTS.

A. Test Equipment.

The following test equipment, or equivalent, is required to check and adjust the r-f oscillator module.

(1) Test Harness 678P-1.

(2) Maintenance Kit 678Y-1.

(3) HP-410B vtvm.

(4) HP-606A signal generator with 80-ZH3 attenuator.

(5) Boonton 91-C vtvm.

(6) Tektronix 541 oscilloscope.

(7) HP-524D frequency counter.

(8) Ballantine 310A vtvm.

B. Equipment Setup.

Connect the 618T-( ) and test equipment as shown in figure 701. Connect the r-f oscillator module to the 618T-( ) chassis through the module extender supplied in the 678Y-1. Leave all other modules in place on the chassis. Remove the r-f oscillator module dust cover.

C. Procedure.

(1) Reference Oscillator Frequency Adjustment.

(a) Connect a receive antenna to the AUX RCVR ANT. connector at the left front of the 618T-( ). The antenna should be located in a low-noise area.

(b) Set the 618T-( ) to USB.

(c) Set the 618T-( ) operating frequency 1 kc below the frequency of WWV.

NOTE: WWV transmits on 2.500 mc, 5.000 mc, 10.000 mc, 15.000 mc, 20.000 mc, and 25.000 mc. Select a frequency that gives a good signal with little fading.

(d) Connect the 541 oscilloscope to the 678P-1 HEADSET jack.

(e) At a time when WWV is not transmitting a tone, observe the 1000-cps signal on the oscilloscope. This signal represents the carrier of WWV.

(f) Hold the 618T-( ) front panel meter selector switch in the CAL TONE position. This connects a 1000-cps reference output from the frequency divider module to the audio output.

(g) Adjust the 714E-( ) RF SENS control until both 1000-cps signals are approximately the same amplitude.

(h) Adjust the FREQ ADJ control for 0 phase drift between the two 1000-cps signals.

(2) Divider Bandwidth Adjustments.

(a) Disconnect the reference oscillator from the dividers by unsoldering the jumper wire.

(b) Connect the 606A signal generator output to J6 and also to the oscilloscope vertical input. Set the signal generator output to 3.000 mc, 50 mv rms

(c) Connect the oscilloscope horizontal input to J4.

(d) Observe the 6-to-1 Lissajous pattern on the oscilloscope. This pattern should be stable (no instantaneous phase changes or fuzziness) as the signal generator is tuned from 2.92 mc to 3.08 mc. If pattern is not stable across this frequency range, adjust C10 and C14 to correct the bandwidth. C10 adjusts bandwidth above 3 mc; C14 adjusts bandwidth below 3 mc.

(e) Increase the signal generator output level to 150 mv rms, and repeat step (d).

(f) Connect the oscilloscope horizontal input to J4, and vertical input to J1. Set the signal generator output to 3.000 mc, 50 mv rms.

(g) Observe the 5-to-1 Lissajous pattern on the oscilloscope. This pattern should be stable as the signal generator is tuned from 2.92 mc to 3.08 mc. If it is not, adjust C29 and C34 to correct the bandwidth. C29 adjusts the bandwidth above 3 mc; C34 adjusts the bandwidth below 3 mc.

(h) Increase the signal generator output level to 150 mv rms, and repeat step (g).

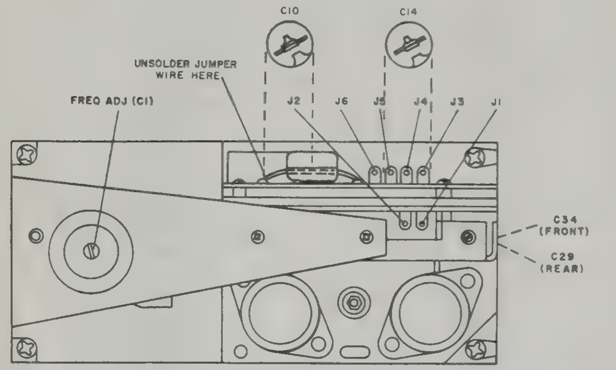
(i) Resolder the jumper wire that was unsoldered in step (a).

(3) Oven Check.

(a) Measure the a-c voltage between terminals 1 and 3 of transformer T3 using the 310A vtvm. Record this value. This voltage, V_{out}, should be several volts.

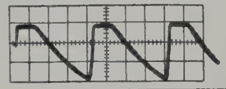
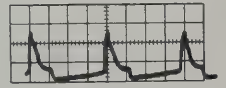
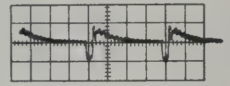
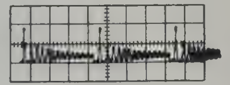
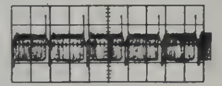
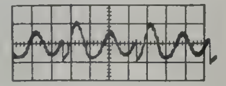
(b) Measure the a-c voltage across diode CR1 using the 310A vtvm. Record this value. This voltage, V_{in}, should be several hundred microvolts.

(c) Compute V_{out}/V_{in}. This quotient should be approximately 6000. If it is less than 6000, oven amplifier has insufficient gain, and Q12 through Q15 and associated circuits should be checked.



R-F Oscillator Module (Early Model) Checks and Adjustments
Figure 716

1. MEGACYCLE-FREQUENCY STABILIZER MODULE TEST POINT DATA.

TEST POINT	QUANTITY BEING TESTED	TEST CONDITIONS	NORMAL INDICATION
J1	H-f oscillator d-c tuning voltage output	Power on	+7.0 ±0.5 volts
J2	Transistor supply voltage	Power on	+18 volts
J3	17.5-mc oscillator d-c tuning voltage output	Power on Operating frequency from 2.000 mc to 6.999 mc	+7.0 ±0.5 volts
J4	H-f oscillator r-f input	Power on	80 mv rms min
J5	17.5-mc oscillator r-f input	Power on	80 mv rms min
J6	500-kc reference input	Power on	Approx 1.0 volt rms
TP1	Squaring amplifier (A1) output at junction of R4 and C7	Oscilloscope set for: 3 volts/cm 0.5 usec/cm	
TP2	Pulse amplifier (Q2) input at junction of of C7 and R5	Oscilloscope set for: 0.5 volt/cm 0.5 usec/cm	
TP3	Spectrum generator (Q3) input at junction of of R6 and R7	Oscilloscope set for: 5 volts/cm 0.5 usec/cm	
TP4	Spectrum generator (Q3) output at junction of L4 and CR1	Oscilloscope set for: 50 volts/cm 0.5 usec/cm	
TP5	Mixer (A1Q3 or A2Q3) input at junction of A1C5 and A1R7 (or A2C5-A2C7)	Oscilloscope set for: 0.5 volt/cm 1 usec/cm	
TP6	Mixer output/i-f amplifier (A1Q4 or A2Q4) input at junction of A1C7 and A1L2 (or A2C7-A2L2)	Oscilloscope set for: 0.5 volt/cm 0.5 usec/cm	

2. MEGACYCLE-FREQUENCY STABILIZER MODULE CHECKS AND ADJUSTMENTS.

A. Test Equipment.

The following test equipment, or equivalent, is required to check and adjust the megacycle-frequency stabilizer module.

(1) Test Harness 678P-1.

(2) Maintenance Kit 678Y-1.

(3) HP-410B vtvm.

(4) Boonton 91-C vtvm.

(5) HP-606A signal generator with 80-ZH3 attenuator.

(6) Tektronix 541 oscilloscope.

B. Equipment Setup.

Connect the 618T-( ) and test equipment as shown in figure 701. Connect the megacycle-frequency stabilizer module to the 618T-( ) chassis through the module extender supplied in the 678Y-1. Leave all other modules in place on the chassis. Remove the megacycle-frequency stabilizer module dust cover.

C. Procedure.

(1) Reference Spectrum Level Adjustment.

(a) Ground J4 and J5.

(b) Connect the 410B vtvm d-c probe to J1. The voltage at this point should be +6.5 ±0.5 volts. If it is not, adjust R7 for the proper voltage at J1.

NOTE: Adjust R7 through the hold in the spectrum-generator board cover.

(c) Connect the 410B vtvm d-c probe to J3. The voltage at this point should be +6.5 ±0.5 volts. If it is not, adjust R7 for the proper voltage at J3.

(d) Recheck the voltage at J1 to be sure it is as specified in step (b). If necessary, readjust R7 until the voltage at both J1 and J3 is +6.5 ±0.5 volts.

(e) Unground J4 and J5.

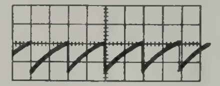
(2) Recycle Check.

(a) Disconnect the two coaxial jumpers on the module extender.

(b) Connect the 606A signal generator output, through the 80-ZH3 attenuator, to the module input at A1 on the module extender. Time the signal generator to 17.503 mc.

(c) Connect the 91-C vtvm to J5. Adjust the signal generator output level for 80 mv rms at J5.

(d) Connect the 541 oscilloscope to J3. Set the oscilloscope for 5 volts 1 cm, d-c, 2 msec/cm. The waveform at J3 should be as shown below.

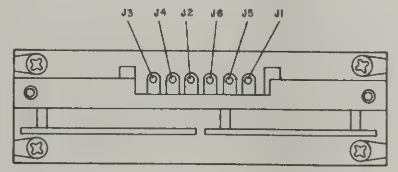


The sawtooth peak value should be +10 to +12 volts, the minimum value should be 0 to +4 volts, and the period should be 2 to 8 msec. If the waveform is improper, trouble is in recycle stage Q4 or associated components.

(e) Connect the 606A signal generator output, through the 80-ZH3 attenuator, to the module input at A2 on the module extender. Tune the signal generator to 8.003 mc.

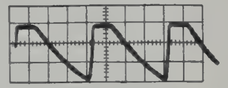
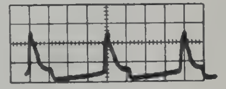
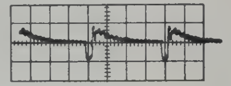
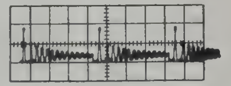
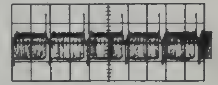
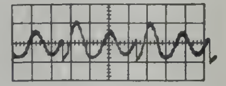
(f) Connect the 91-C vtvm to J4. Adjust the signal generator output level for 80 mv rms at J4.

(g) Connect the 541 oscilloscope to J1. Set the oscilloscope for 5 volts/cm, d-c, 2 msec/cm. The waveform at J1 should be the same as the one specified in step (d). If it is not, trouble is in recycle stage Q5 or associated components.



Megacycle-Frequency Stabilizer Module (Early Model) Checks and Adjustments
Figure 717

1. MEGACYCLE-FREQUENCY STABILIZER MODULE TEST POINT DATA.

TEST POINT	QUANTITY BEING TESTED	TEST CONDITIONS	NORMAL INDICATION
J1	H-f oscillator d-c tuning voltage output	Power on	+7.0 ±0.5 volts
J2	Transistor supply voltage	Power on	+18 volts
J3	17.5-mc oscillator d-c tuning voltage output	Power on Operating frequency from 2.000 mc to 6.999 mc	+7.0 ±0.5 volts
J4	H-f oscillator r-f input	Power on	80 mv rms min
J5	17.5-mc oscillator r-f input	Power on	80 mv rms min
J6	500-kc reference input	Power on	Approx 1.0 volt rms
TP1	Squaring amplifier (A1) output at junction of R4 and C7	Oscilloscope set for: 3 volts/cm 0.5 usec/cm	
TP2	Pulse amplifier (Q2) input at junction of of C7 and R5	Oscilloscope set for: 0.5 volt/cm 0.5 usec/cm	
TP3	Spectrum generator (Q3) input at junction of of R6 and R7	Oscilloscope set for: 5 volts/cm 0.5 usec/cm	
TP4	Spectrum generator (Q3) output at junction of L4 and CR1	Oscilloscope set for: 50 volts/cm 0.5 usec/cm	
TP5	Mixer (A1Q3 or A2Q3) input at junction of A1C5 and A1R7 (or A2C5-A2C7)	Oscilloscope set for: 0.5 volt/cm 1 usec/cm	
TP6	Mixer output/i-f amplifier (A1Q4 or A2Q4) input at junction of A1C7 and A1L2 (or A2C7-A2L2)	Oscilloscope set for: 0.5 volt/cm 0.5 usec/cm	

2. MEGACYCLE-FREQUENCY STABILIZER MODULE CHECKS AND ADJUSTMENTS.

A. Test Equipment.

The following test equipment, or equivalent, is required to check and adjust the megacycle-frequency stabilizer module.

(1) Test Harness 678P-1.

(2) Maintenance Kit 678Y-1.

(3) HP-410B vtvm.

(4) Boonton 91-C vtvm.

(5) HP-606A signal generator with 80-ZH3 attenuator.

(6) Tektronix 541 oscilloscope.

B. Equipment Setup.

Connect the 618T-( ) and test equipment as shown in figure 701. Connect the megacycle-frequency stabilizer module to the 618T-( ) chassis through the module extender supplied in the 678Y-1. Leave all other modules in place on the chassis. Remove the megacycle-frequency stabilizer module dust cover.

C. Procedure.

(1) Reference Spectrum Level Adjustment.

(a) Ground J4 and J5.

(b) Connect the 410B vtvm d-c probe to J1. The voltage at this point should be +6.5 ±0.5 volts. If it is not, adjust R7 for the proper voltage at J1.

NOTE: Adjust R7 through the hold in the spectrum-generator board cover.

(c) Connect the 410B vtvm d-c probe to J3. The voltage at this point should be +6.5 ±0.5 volts. If it is not, adjust R7 for the proper voltage at J3.

(d) Recheck the voltage at J1 to be sure it is as specified in step (b). If necessary, readjust R7 until the voltage at both J1 and J3 is +6.5 ±0.5 volts.

(e) Unground J4 and J5.

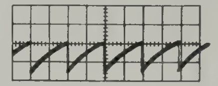
(2) Recycle Check.

(a) Disconnect the two coaxial jumpers on the module extender.

(b) Connect the 606A signal generator output, through the 80-ZH3 attenuator, to the module input at A1 on the module extender. Time the signal generator to 17.503 mc.

(c) Connect the 91-C vtvm to J5. Adjust the signal generator output level for 80 mv rms at J5.

(d) Connect the 541 oscilloscope to J3. Set the oscilloscope for 5 volts 1 cm, d-c, 2 msec/cm. The waveform at J3 should be as shown below.

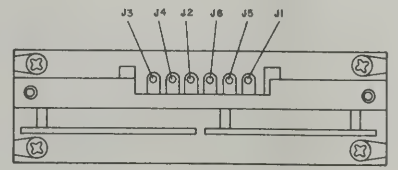


The sawtooth peak value should be +10 to +12 volts, the minimum value should be 0 to +4 volts, and the period should be 2 to 8 msec. If the waveform is improper, trouble is in recycle stage Q4 or associated components.

(e) Connect the 606A signal generator output, through the 80-ZH3 attenuator, to the module input at A2 on the module extender. Tune the signal generator to 8.003 mc.

(f) Connect the 91-C vtvm to J4. Adjust the signal generator output level for 80 mv rms at J4.

(g) Connect the 541 oscilloscope to J1. Set the oscilloscope for 5 volts/cm, d-c, 2 msec/cm. The waveform at J1 should be the same as the one specified in step (d). If it is not, trouble is in recycle stage Q5 or associated components.



Megacycle-Frequency Stabilizer Module (Early Model) Checks and Adjustments
Figure 717

CHAPTER 9

TROUBLESHOOTING

CHAPTER 9

TROUBLE SHOOTING

Table of Contents

List of Tables

1. GENERAL.

This chapter is divided into two main divisions. These divisions, and a brief description of what each division contains, are listed below.

A. Unit Trouble Shooting.

The unit trouble-shooting division contains information that is to be used, after performing the unit performance check in the testing section, to isolate trouble to a particular module or group of modules.

B. Module Trouble Shooting.

The module trouble-shooting division contains information that aids in isolating trouble within a module to a particular stage or group of stages. This information should be referred to if the module checks and adjustments in the testing section fail to restore a module to proper operation.

2. UNIT TROUBLE SHOOTING.

Refer to tables 801 through 805 for 618T-( ) unit trouble-shooting data.

TABLE 801. GENERAL TROUBLE-SHOOTING DATA

SYMPTOM	ACTION
618T-( ) dead. Power not applied.	Check primary power sources (both a-c and d-c). Check circuit breaker and fuses in Test Harness 678P-1. Check control unit mode selector switch to see that power-enabling ground is being supplied to pin 59 of 618T-( ) connector P40. If all of above checks are positive, check 618T-( ) chassis relays K1 and K9.

TABLE 802. FREQUENCY TROUBLE-SHOOTING CHART

SYMPTOM	ACTION
618T-( ) r-f output frequency abnormal below 7.000 mc, but normal above 7.000 mc.	Perform 17.5-mc oscillator phase-locking check (r-f translator module).

TABLE 802. FREQUENCY TROUBLE-SHOOTING CHART (Cont)

SYMPTOM	ACTION
618T-( ) r-f output frequency abnormal both above and below 7.000 mc.	Perform vfo and h-f oscillator phase-locking checks (r-f translator module). Perform the reference oscillator frequency adjustment (r-f oscillator module).
618T-( ) r-f output frequency varies from the desired frequency by an integral number of kilocycles.	Remove the kilocycle-frequency stabilizer module from the 618T-( ) chassis. Connect the 410B vtvm d-c probe to pin 2 of chassis connector J12. The voltage at this point should be +18 volts. Rechannel the 618T-( ). The voltage at J12-2 should drop to 0 during the time that the 618T-( ) is mechanically tuning. There should be a discernible delay (1/2 to 1 second) between the time that mechanical tuning is completed and +18 volts returns to J12-2. If there is not, check chassis relays K8 and K10 and components on chassis terminal board TB2.

TABLE 803. RECEIVE TROUBLE-SHOOTING CHART

SYMPTOM	ACTION
Gain abnormal, but sensitivity normal.	Perform audio amplifier gain adjustment (AM/audio amplifier module).
Sensitivity abnormal, but gain normal.	Perform receive i-f output adjustment, variable/band-pass i-f alignment check, and r-f circuits alignment (r-f translator module).
Gain abnormal in USB and LSB, but normal in AM.	Perform SSB receive i-f alignment (i-f translator module).
Gain abnormal in AM, but normal in USB and LSB.	Perform AM receive i-f alignment (AM/audio amplifier module).

TABLE 804. TRANSMIT TROUBLE-SHOOTING CHART

SYMPTOM	ACTION
Transmit output power abnormal.	Perform tgc adjustment and driver plate tuning adjustments (unit adjustments). Perform SSB/AM transmit i-f alignment (i-f translator module).

TABLE 804. TRANSMIT TROUBLE-SHOOTING CHART (Cont)

SYMPTOM	ACTION
Transmit output power abnormal (Cont).	Perform r-f circuits alignment and variable/band-pass i-f alignment check (r-f translator module. Perform neutralization adjustments (r-f translator module).
Transmit residual noise abnormal.	Perform carrier balance adjustment (i-f translator module). Perform transmit h-f mixer balance adjustment (r-f translator module).
Power amplifier static plate current abnormal.	Perform static plate current adjustment (unit adjustments).
Power amplifier tube balance abnormal.	Replace power amplifier tubes. Repeat check.
CW output abnormal.	Check CW keying circuits in AM/audio amplifier module.
AM modulation abnormal.	Perform audio amplifier gain adjustment (AM/audio amplifier module).
Sidetone abnormal.	Check chassis relay K6.

TABLE 805. ANTENNA COUPLER POWER/CONTROL TROUBLE-SHOOTING CHART

SYMPTOM	ACTION
+260-volt output abnormal.	Check high-voltage power supply module.
115-volt a-c output abnormal.	Check chassis relays K1 and K9.
+28-volt output abnormal.	Check chassis relays K1 and K9.
Transmitter key interlock abnormal.	Check chassis relay K7.
Chopper enable abnormal.	Check chassis relay K3.
Tune power enable.	Check keying and SSB/AM transfer relays.
Recycle line abnormal.	Check chassis relay K4.
Key line abnormal.	Check chassis relays K2, K3, and K5.

3. MODULE TROUBLE SHOOTING.

Refer to tables 806 through 817 for 618T-( ) module trouble-shooting data.

TABLE 806. MODULE SUPPLY VOLTAGE DATA

MODULE	TEST POINT (MODULE EXTENDER)	SUPPLY VOLTAGE	
Low-voltage power supply	TP4	+28 volts	
	TP8	115 volts rms	
	TP10	+25 volts	
AM/audio amplifier	TP5	+18 volts	
	TP6	+25 volts	
	TP11	+18 volts (receive only)	
	TP21	+28 volts	
I-f translator	TP5	+18 volts	
	TP11	+18 volts (receive only)	
	TP14	+28 volts	
R-f translator	J32	618T-1/2	618T-3
	TP9		0
		>6.3 volts rms	
	TP10		+6.3 volts
		>6.3 volts rms	
	TP11		+12.6 volts
		>6.3 volts rms	
	TP12		+18.9 volts
		>6.3 volts rms	
	TP13		+25.2 volts
	TP17	+28 volts	
	TP18	+130 volts	
	TP19	+260 volts (transmit only)	
	TP28	+18 volts	
	TP31	Approx +10.3 volts	
	TP14 (J33)	+28 volts d-c	

TABLE 806. MODULE SUPPLY VOLTAGE DATA (Cont)

MODULE	TEST POINT (MODULE EXTENDER)	SUPPLY VOLTAGE
Electronic control amplifier	TP3	+25 volts
	TP7	6.3 volts rms
R-f oscillator	TP5	+18 volts
Frequency divider	TP2	+18 volts
Kilocycle-frequency stabilizer	TP2	+18 volts (interrupted during recycle)
	TP8	+18 volts
Megacycle-frequency stabilizer	J2 (in module)	+18 volts

TABLE 807. LOW-VOLTAGE POWER SUPPLY MODULE TROUBLE-SHOOTING CHART

SYMPTOM	ACTION
Abnormal indication at J1.	Replace Q2. Repeat check.
Abnormal indication at J2.	Check +28-volt power source.
Abnormal indication at J3.	Perform +18-volt regulator adjustment (low-voltage power supply module).

TABLE 808. HIGH-VOLTAGE POWER SUPPLY MODULE TROUBLE-SHOOTING CHART

SYMPTOM	ACTION
+1500-volt or +260-volt output abnormal.	Check all diodes and capacitors in the high-voltage power supply module with an ohmmeter. Also check transformer continuity.

TABLE 809. AM/AUDIO AMPLIFIER MODULE TROUBLE-SHOOTING CHART

SYMPTOM	ACTION
Abnormal indication at J1. Normal indication at J2.	Check Q7 and associated circuit.
Abnormal indication at J2. Normal indication at J1.	Check envelope detector diode CR4.
Abnormal indication at J3.	Check microphone.
Abnormal indication at J4. Normal indication at J3.	Check Q1, Q2, and associated circuits.
Abnormal indication at J5. Normal indication at J4.	Check CR2, CR7, CR13, and associated circuits.
Abnormal indication at J6. Normal indication at J2.	Check Q9 and associated circuit.

TABLE 810. I-F TRANSLATOR MODULE TROUBLE-SHOOTING CHART

SYMPTOM	ACTION
Abnormal indication at J1.	Check indication at J1 in AM/audio amplifier module. Should be same.
Abnormal indication at J2.	Check Q6 and associated circuit.
Abnormal indication at J3.	Check indication at J4 in AM/audio amplifier module.
Abnormal indication at J4.	Check indication at J4 in r-f oscillator module.

TABLE 811. R-F TRANSLATOR MODULE TROUBLE-SHOOTING CHART

SYMPTOM	ACTION
Abnormal indication at J1.	Check V10 and associated circuit.
Abnormal indication at J2. Normal indication at J9.	Check V1, V2, V3, V10, and associated circuits.

TABLE 811. R-F TRANSLATOR MODULE TROUBLE-SHOOTING CHART (Cont)

SYMPTOM	ACTION
Abnormal indication at J3. Normal indication at J2.	Check V3, V11, and associated circuits.
Abnormal indication at J4. Normal indication at J3.	Check V4, V5, and associated circuits.
Abnormal indication at J5.	Check vfo.
Abnormal indication at J6. Normal indication at J2.	Check band-pass i-f filter.
Abnormal indication at J7.	Check V11 and associated circuit.
Abnormal indication at J8.	Check relay K3.
Abnormal indication at J9.	Check transmit i-f output of i-f translator module.

TABLE 812. POWER AMPLIFIER MODULE TROUBLE-SHOOTING CHART

SYMPTOM	ACTION
Abnormal indication at J1. Normal indication at J4.	Check resistor R1.
Abnormal indication at J2. Normal indication at J4.	Check R4, R5, CR6.
Abnormal indication at J3. PA B+ normal.	Check R29 through R34, C38, C45, C51, and C52.
Abnormal indication at J4. Normal indication at J2.	Check R16, R9, R2, R15, and CR5.
Abnormal indication at J5.	Check adc circuit.

TABLE 813. ELECTRONIC CONTROL AMPLIFIER MODULE TROUBLE-SHOOTING CHART

SYMPTOM	ACTION
Abnormal indication at J1.	Check G1, Q1, and associated circuits.
Abnormal indication at J2. Normal indication at J1.	Check Q2, Q3, Q4, and associated circuits.
Abnormal indication at J3 and J4. Normal indication at J2.	Check Q5, Q6, Q7, and associated circuits.

TABLE 814. R-F OSCILLATOR MODULE TROUBLE-SHOOTING CHART

SYMPTOM	ACTION
Abnormal indication at J1. Normal indication at J3.	Check Q7, Q8, Q9, and associated circuits.
Abnormal indication at J2.	Check supply voltage at J3 in low-voltage power supply.
Abnormal indication at J3. Normal indication at 3-mc test point.	Check Q4, Q5, and associated circuits.
Abnormal indication at J4. Normal indication at J3.	Check Q6 and associated circuit.
Abnormal indication at 3-mc test point. Normal indication at +18-volt d-c test point.	Replace temperature-compensated crystal

TABLE 815. FREQUENCY DIVIDER MODULE TROUBLE-SHOOTING CHART

SYMPTOM	ACTION
Abnormal indication at J1. Normal indication at TP2.	Check Q5, Q6, and associated circuits.
Abnormal indication at J2.	Check supply voltage at J3 in low-voltage power supply.
Abnormal indication at J3. Normal indication at TP4.	Check Q11, Q12, Q13, and associated circuits.
Abnormal indication at TP1.	Check 100-kc output at J1 in r-f oscillator. Check Q1, Q2, and associated circuits.
Abnormal indication at TP2. Normal indication at TP1.	Check Q3, Q4, and associated circuits.
Abnormal indication at TP3. Normal indication at TP2.	Check Q7, Q8, and associated circuits.
Abnormal indication at TP4. Normal indication at TP3.	Check Q9 and associated circuit.

TABLE 816. KILOCYCLE-FREQUENCY STABILIZER MODULE TROUBLE-SHOOTING CHART

SYMPTOM	ACTION
Abnormal indication at J1.	Check vfo output at J5 in r-f translator.
Abnormal indication at J2.	Check supply voltage at J3 in low-voltage power supply.
Abnormal indication at J3.	Check R62.
Abnormal indication at J4.	Check resistors R1 through R20 and switches S3 and S4 in the Autopositioner.
Abnormal indication at J5. Normal indication at J6.	Check Q4, Q12, and associated circuits.
Abnormal indication at J6.	Check resistors R22 through R32 and switch S6 in the Autopositioner.
Abnormal indication at J7. Normal indication at TP2.	Check Q3, FL1, and associated circuits.
Abnormal indication at J8. Normal indication at TP12.	Check Q15, FL2, and associated circuits.
Abnormal indication at TP1. Normal indication at J1.	Check Q1 and associated circuit.
Abnormal indication at TP2. Normal indication at TP1.	Check Q2 and associated circuit.
Abnormal indication at TP4. Normal indication at J7.	Check Q5, Q6, and associated circuits.
Abnormal indication at TP5. Normal indication at TP4.	Check Q7, Q8, and associated circuits.
Abnormal indication at TP7. Normal indication at TP5.	Check frequency discriminator circuit.
Abnormal indication at TP8. Normal indication at TP10.	Check T2.
Abnormal indication at TP9.	Check supply voltage at J3 in low-voltage power supply.
Abnormal indication at TP10. Normal indication at TP19.	Check Q11 and associated circuit.
Abnormal indication at TP11.	Check 10-kc pulse output at J1 in frequency divider.

TABLE 816. KILOCYCLE-FREQUENCY STABILIZER MODULE TROUBLE-SHOOTING CHART (Cont)

SYMPTOM	ACTION
Abnormal indication at TP12. Normal indication at J5.	Check keyed oscillator output at J3 in frequency divider.
Abnormal indication at TP14. Normal indication at J8.	Check Q16, Q17, and associated circuits.
Abnormal indication at TP15. Normal indication at TP14.	Check Q18, Q19, and associated circuits.
Abnormal indication at TP16. Normal indication at TP5.	Check T1.
Abnormal indication at TP17/TP18.	Check phase discriminator circuit.
Abnormal indication at TP19. Normal indication at TP11.	Check Q9, Q10, and associated circuits.

TABLE 817. MEGACYCLE-FREQUENCY STABILIZER MODULE TROUBLE-SHOOTING CHART

SYMPTOM	ACTION
Abnormal indication at J1. Normal indication at J4.	Check amplifier/detector board A2.
Abnormal indication at J2.	Check supply voltage at J3 in low-voltage power supply.
Abnormal indication at J3. Normal indication at J5.	Check amplifier/detector board A1.
Abnormal indications at J1 and J3.	Check spectrum generator subassembly.
Abnormal indication at J4.	Check V11 in r-f translator module.
Abnormal indication at J5.	Check V10 in r-f translator module.

APPENDIX I

REFERENCES

Following is a list of references available to the direct and general support and depot maintenance repairman of the radio set:

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 4, 6, 7, 8, and 9), Supply Bulletins, Lubrication Orders, and Modification Work Orders.
TM 11-5527	Multimeters TS-352/U, TS-352A/U, and TS-352B/U.
TM 11-5551E	R. F. Signal Generator AN/URM-25F.
TM 11-5821-249-15	Operator's, Organizational, Field and Depot Maintenance Manual: Coupler, Antenna Group AN/ARA-41.
TM 11-5915-201-15	Operator, Organizational, Field and Depot Maintenance Mannual Network, Impedance Matching CU-991( )/AR.
TM 11-6625-200-12	Operator and Organizational Maintenance Manual, Multimeters ME-26A/U and ME-26B/U.
TM 11-6625-219-12	Operator's and Organizational Maintenance Manual, Oscilloscope AN/USM-81.
TM 11-6625-261-12	Operator's and Organizational Maintenance Manual, Audio Oscillators TS-382A/U, TS-382B/U, TS-382D/U, TS-382E/U, and TS-382F/U.
TM 11-6625-320-12	Operator's and Organizational Maintenance Manual, Voltmeter, Meter ME-30A/U and Voltmeters, Electronic ME-30B/U and ME-30C/U.
TM 11-6625-438-10	Operator's Manual: Voltmeter, Electronic AN/USM-98.

APPENDIX II

SPECIAL TEST EQUIPMENT

APPENDIX II

SPECIAL TEST EQUIPMENT

Table of Contents

List of Illustrations

List of Tables

1. GENERAL.

This appendix contains information regarding special tools and test equipment required to align, test, or trouble shoot Airborne SSB Transceiver 618T-( ).

2. TEST HARNESS 678P-1.

A. General.

Test Harness 678P-1, Collins part number 547-3914-00, furnishes a means of connecting and controlling Transceiver 618T-1, 618T-2, or 618T-3 while it is being tested and adjusted. Control Unit 714E-1, 714E-2, or 714E-3 may be plugged into Test Harness 678P-1 to control the 618T-( ). The control unit is not furnished as part of the 678P-1.

Test Harness 678P-1 is 8-1/2 inches wide, 9-9/16 inches high, and 16 inches deep. It weighs approximately 25 pounds, including connecting cables which are furnished with the 678P-1. All operating controls are located on a sloping front panel for convenient operation. All power connectors and protective components are located on a horizontal rear deck.

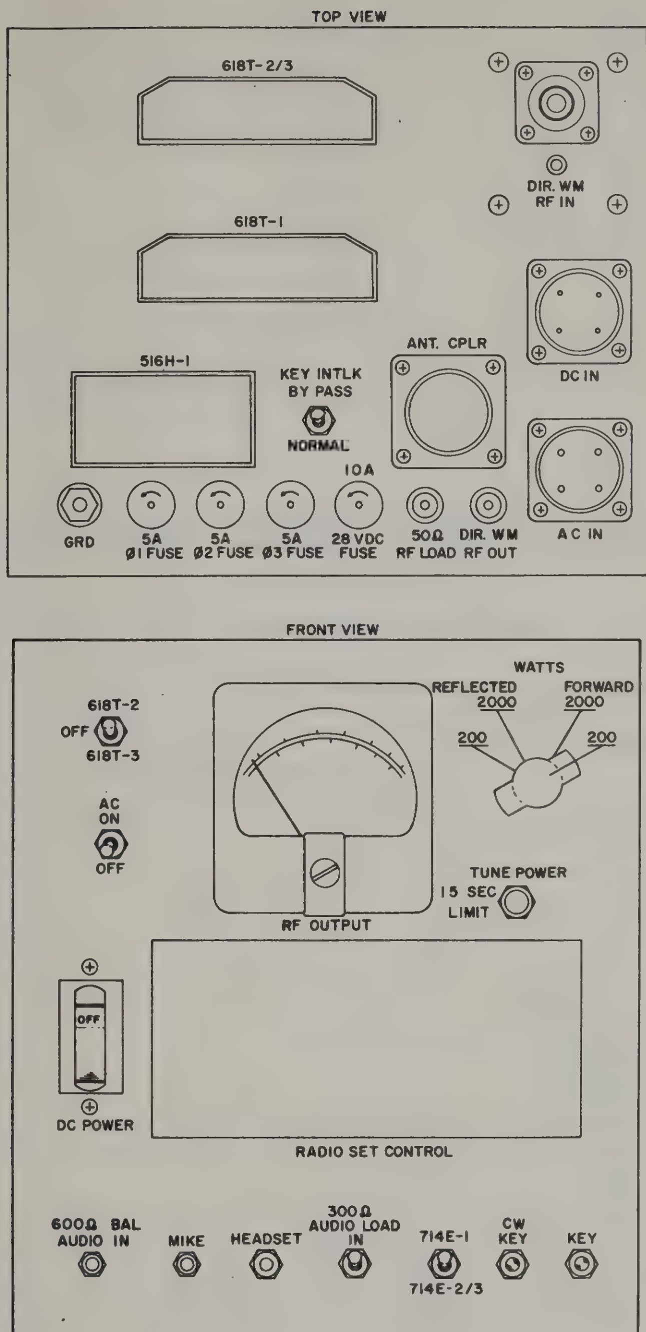
Table 1001 lists the equipment supplied as part of Test Harness 678P-1. Table 1002 lists equipment required but not supplied.

B. Functions.

Refer to figure 1001. Test Harness 678P-1 has switches that control the power, both a-c and d-c, which is supplied to the 618T-( ) being tested. All power inputs are fused. There are switches for keying the 618T-( ), including CW keying. A directional r-f wattmeter is provided for measuring both forward and reflected power. Jacks are provided for connecting audio inputs and monitoring the audio output. The KEY INTLK switch provides for use of Test Harness 678P-1 either with or without an antenna coupler. The TUNE POWER button grounds the 618T-( ) tune power line. Figure 1002 is a schematic diagram of Test Harness 678P-1.

TABLE 1001
TEST HARNESS 678P-1, COLLINS PART NUMBER 547-3914-00, EQUIPMENT SUPPLIED

ITEM	COLLINS PART NUMBER
Test harness assembly	548-8292-005
618T-1/2/3 pendant cable	548-8002-004
516H-1 pendant cable	548-8003-004
27.5-volt d-c power cable	548-8023-003
115-volt, 3-phase, 400-cps power cable	548-8025-003
714E-1/2 pendant cable	548-8029-004
714E-3 pendant cable	548-8284-004
180L-2/3 pendant cable	548-8287-004
309A-2D pendant cable	548-8286-004
309A-1 pendant cable	548-8285-004
CU-351 pendant cable	554-2915-004
Coaxial cable	549-4334-002
R-f adapter connectors (2)	357-9291-00



Test Harness 678P-1, Front Panel and Top View
Figure 1001

TABLE 1002. TEST HARNESS 678P-1, EQUIPMENT REQUIRED BUT NOT SUPPLIED

ITEM	COLLINS PART NUMBER
Control Unit 714E-1	522-1261-00
or	
Control Unit 714E-2	522-2313-00
or	
Control Unit 714E-3	522-2457-00

C. Cable Data.

Table 1003 lists cable continuity data for the 10 power and pendant cables supplied with Test Harness 678P-1.

TABLE 1003. 678P-1 CABLE CONTINUITY DATA

CABLE	PIN OF 678P-1 CONNECTOR	PIN OF EQUIPMENT CONNECTOR
618T-1/2/3 pendant cable NOTE: Wires connecting pins 54 and pins 60 are shielded. Wire connecting pins 37 and 53, pins 57 and 58 are shielded twisted pairs.	1 thru 60	1 thru 60
516H-1 pendant cable	1 2 3 6 8 10 11 13	1 2 3 6 8 10 11 13

TABLE 1003. 678P-1 CABLE CONTINUITY DATA (Cont)

CABLE	PIN OF 678P-1 CONNECTOR	PIN OF EQUIPMENT CONNECTOR
516H-1 pendant cable (Cont)	14	14
	16	16
	17	17
	19	19
	21	21
	22	22
	23	23
27.5-volt d-c power cable	A	-d-c source voltage
	B	
	C	+d-c source voltage
	D	
115-volt, 3-phase, 400-cps power cable powe	A	3-phase source
	B	
	C	
	D	source ground
714E-1/2 pendant cable NOTE: Pins k and p of the connector at the 678P-1 end of the cable are jumped.	A	U
	B	T
	C	S
	D	R
	E	K
	F	Y
	G	M
	H	L
	J	G
	K	P
	L	J
	M	F
	N	C
	P	N
	R	H
	S	E
	T	D
	U	Z
	V	f
	W	e
	X	l
	Y	k
	Z	v
	a	a
	b	m

TABLE 1003. 678P-1 CABLE CONTINUITY DATA (Cont)

CABLE	PIN OF 678P-1 CONNECTOR	PIN OF EQUIPMENT CONNECTOR
714E-1/2 pendant cable (Cont)	c	b
	d	A
	f	j
	g	h
	h	g
	i	w
	j	d
	m	x
	q	c
	r	B
714E-3 pendant cable	A	A
	B	B
	C	C
	D	D
	E	E
	F	F
	G	G
	H	H
	J	J
	K	K
	L	L
	M	M
	N	N
	P	P
	R	R
	S	S
	T	T
	U	U
	V	V
	W	W
	X	X
	Y	Y
	Z	Z
	a	a
	b	b
	c	c
	d	d
	e	e
	f	h
	g	g
	h	f
	i	i
	j	j
	k	k

TABLE 1003. 678P-1 CABLE CONTINUITY DATA (Cont)

CABLE	PIN OF 678P-1 CONNECTOR	PIN OF EQUIPMENT CONNECTOR
714E-2 pendant cable (Cont)	m	m
	n	n
	p	p
	q	q
	r	r
180L-2/3 pendant cable	A	14
	K	10
	R	9
	T	8
	X	12
	Z	3
	f	1
	i	7
	j	15
	$\underline{k}$	4
	$\underline{m}$	2
	r	13
	$\underline{s}$	11
309A-2D pendant cable	B	B
	C	C
	D	D
	E	Z
	K	T
	N	V
	R	R
	S	b
	T	a
	U	$\underline{c}$
	V	Y
	W	S
	X	E
	Y	P
	Z	N
	a	F
	b	U
	d	J
	e	H
	f	X
	g	K
	h	A
	j	G
	$\underline{k}$	W
	$\underline{m}$	M
	t	L

TABLE 1003. 678P-1 CABLE CONTINUITY DATA (Cont)

CABLE	PIN OF 678P-1 CONNECTOR	PIN OF EQUIPMENT CONNECTOR
309A-1 pendant cable	B	25
	C	24
	D	23
	E	4
	F	34
	G	35
	H	32
	J	6
	K	10
	M	33
	N	8
	P	12
	R	2
	T	3
	U	1
	V	5
	W	11
	X	27
	Y	13
	Z	14
	b	9
	c	31
	d	18
	e	19
	f	16
	g	17
	h	26
	j	20
	k	7
	m	15
	q	30
	r	29
	s	28
CU-351 pendant cable	A	A
	K	N
	R	R
	T	B
	X	F
	Z	S
	f	T
	i	C
	j	G
	k	M
	m	K
	r	D
	s	E

3. MAINTENANCE KIT 678Y-1.

Maintenance Kit 678Y-1, Collins part number 547-3915-00, is composed of assorted items which aid in aligning, testing, and trouble shooting Transceiver 618T-( ). These items are contained in a cabinet that is supplied as part of the kit.

The 678Y-1 includes module extenders for most of the 618T-( ) modules. These extenders permit modules to be extended outside the 618T-( ) chassis while they are operating. This makes the modules more accessible for testing or trouble shooting. Test points on the extenders bring some of the pins on the module plugs out to test jacks so that the voltages at these pins may be measured easily.

Maintenance Kit 678Y-1 also includes a number of special test probes, test cables, and tuning or alignment tools which facilitate 618T-( ) maintenance procedures.

Figures 1003 and 1004 shows the 678Y-1 cabinet and components. Table 1004 lists the Collins part number of each of the kit components.

TABLE 1004. MAINTENANCE KIT 678Y-1, COLLINS PART NUMBER 547-3915-00, EQUIPMENT SUPPLIED

ITEM	COLLINS PART NUMBER
Cabinet	554-4851-005
Radio set test fixture	549-0990-004
Extender, r-f translator	548-3452-00
Extender, r-f oscillator	548-3463-00
Extender, megacycle-frequency stabilizer	548-3501-004
Extender, frequency divider	548-3502-004
Extender, AM/audio amplifier	548-3461-004
Extender, i-f translator	548-3505-00
Extender, electronic control amplifier	548-3453-004
Extender, low-voltage power supply	548-3455-004
Extender, kilocycle-frequency stabilizer	548-3459-004
Autopositioner frame	548-8014-003
Dial	548-3530-002
Setscrews, 4-40 (2)	328-0048-00
Machine screws 4-40 x 1/4 (3)	343-0133-00

TABLE 1004. MAINTENANCE KIT 678Y-1, COLLINS PART NUMBER 547-3915-00, EQUIPMENT SUPPLIED (Cont)

ITEM	COLLINS PART NUMBER
Pointer	549-0974-002
Capacity divider, 2 to 8 mc	548-3525-002
Capacity divider, 8 to 30 mc	548-3528-002
R-f translator load	549-0989-003
Neutralizing detector	548-3533-003
50-ohm signal generator load	548-3522-002
Test probe no. 1	548-3486-002
Test probe no. 2	548-3484-002
Test probe no. 3	548-3499-002
Phone cable	548-3489-002
Mike cable	548-3490-002
Coaxial jumper cables (6)	546-7321-002
BNC T-adapter (UG-274A/U)	357-9314-00
BNC straight adapter (UG-914/U)	357-9329-00
BNC straight adapter (UG-491/U)	357-9337-00
Shielded-cap double banana plug (2)	361-0154-00
7-pin tube extender	220-1461-00
9-pin tube extender	220-1463-00
PA tube extractor	024-0307-00 or 024-0345-00
Tuning tool	547-2796-002
Alignment tool no. 1	024-0295-00
Alignment tool no. 2	024-0309-00
Bristo wrench, no. 8	024-0019-00
Bristo wrench, no. 4	024-2900-00

TABLE 1004. MAINTENANCE KIT 678Y-1, COLLINS PART NUMBER 547-3915-00, EQUIPMENT SUPPLIED (Cont)

ITEM	COLLINS PART NUMBER
Bristo wrench no. 8 (with handle)	024-2700-00
Phillips screwdriver, no. 2	024-0310-00
Printed circuit repair kit	549-0637-00
R-f cable	549-4334-002

4. FUNCTION TEST SET 678Z-1.

A. General.

Function Test Set 678Z-1, Collins part number 548-8001-005, performs several test functions used in unit and module testing and adjusting of the 618T-( ). The 678Z-1 can act as an accurate voltage comparator which may be used to set some of the voltages in the 618T-( ). It may also be used as a variable voltage source with three different source impedances. In addition, Function Test Set 678Z-1 contains a dummy microphone which is used to connect audio tone inputs to the 618T-( ).

The operations that are performed by the 678Z-1 with the FUNCTION SELECTOR switch on the front panel set to its various positions are listed at each switch position.

Figure 1005 is an over-all view of Function Test Set 678Z-1. Figure 1006 is a schematic diagram of the 678Z-1. Table 1005 lists equipment supplied as part of the 678Z-1.

TABLE 1005. FUNCTION TEST SET 678Z-1, EQUIPMENT SUPPLIED

ITEM	COLLINS PART NUMBER
Function test set 678Z-1	548-8001-005
Test lead no. 1 (orange jacks)	549-1006-003
Test lead no. 2 (white jacks)	549-1007-003
Test lead no. 3 (brown jacks)	549-1008-003
Test lead no. 4 (red jacks)	549-1009-003
Test lead no. 5 (yellow jacks)	549-1010-003
Test lead (black jack)	549-1005-002
Test lead bag	024-0252-00
Power cable	548-3539-002

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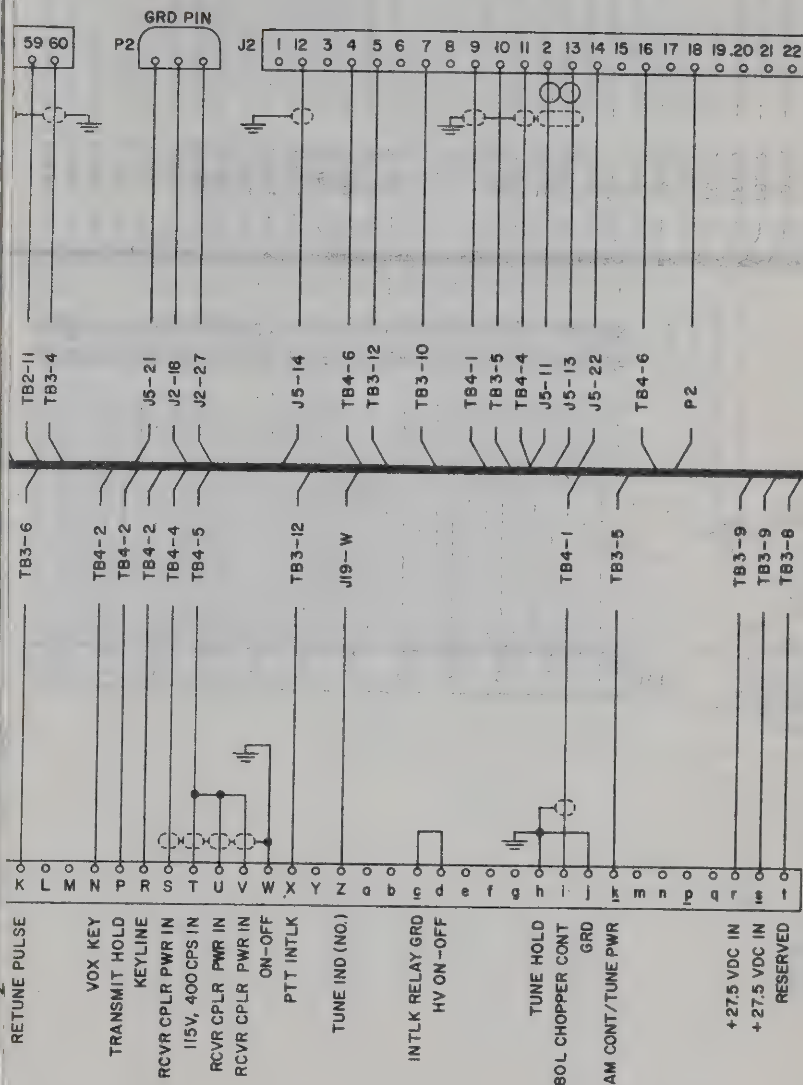

Harness 678P-1, Schematic Diagram
(Sheet 2 of 2)
Figure 1002

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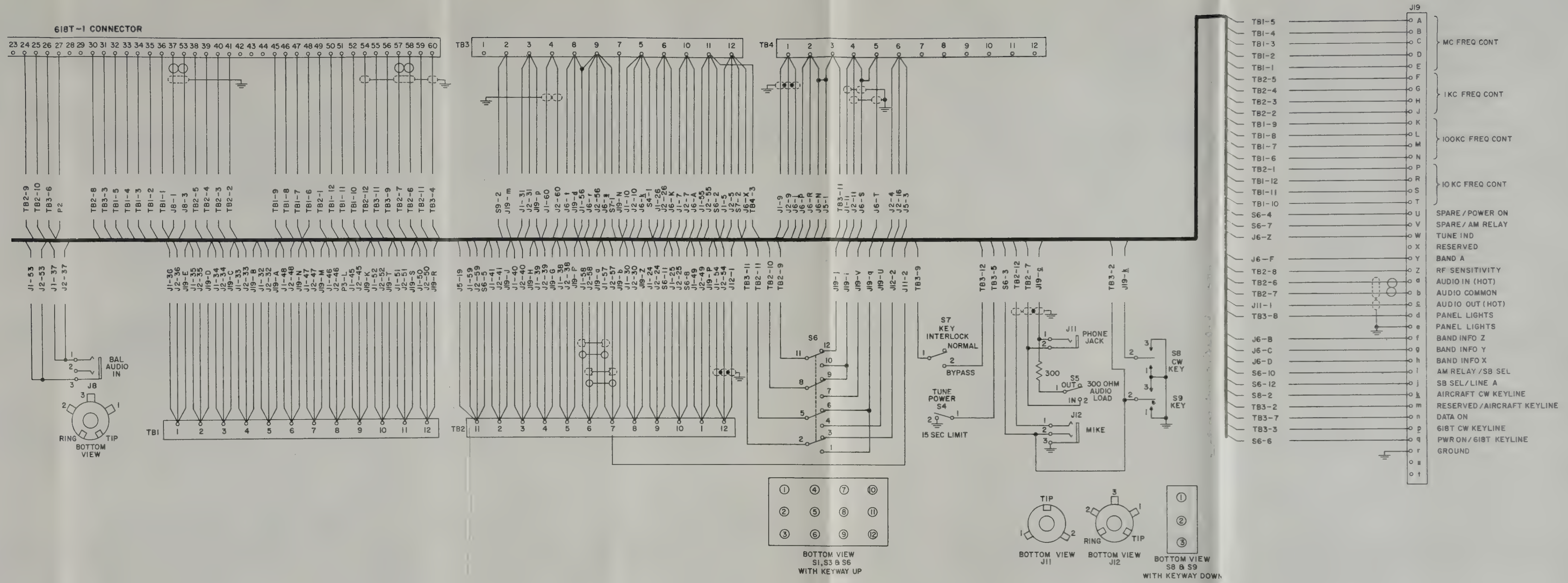
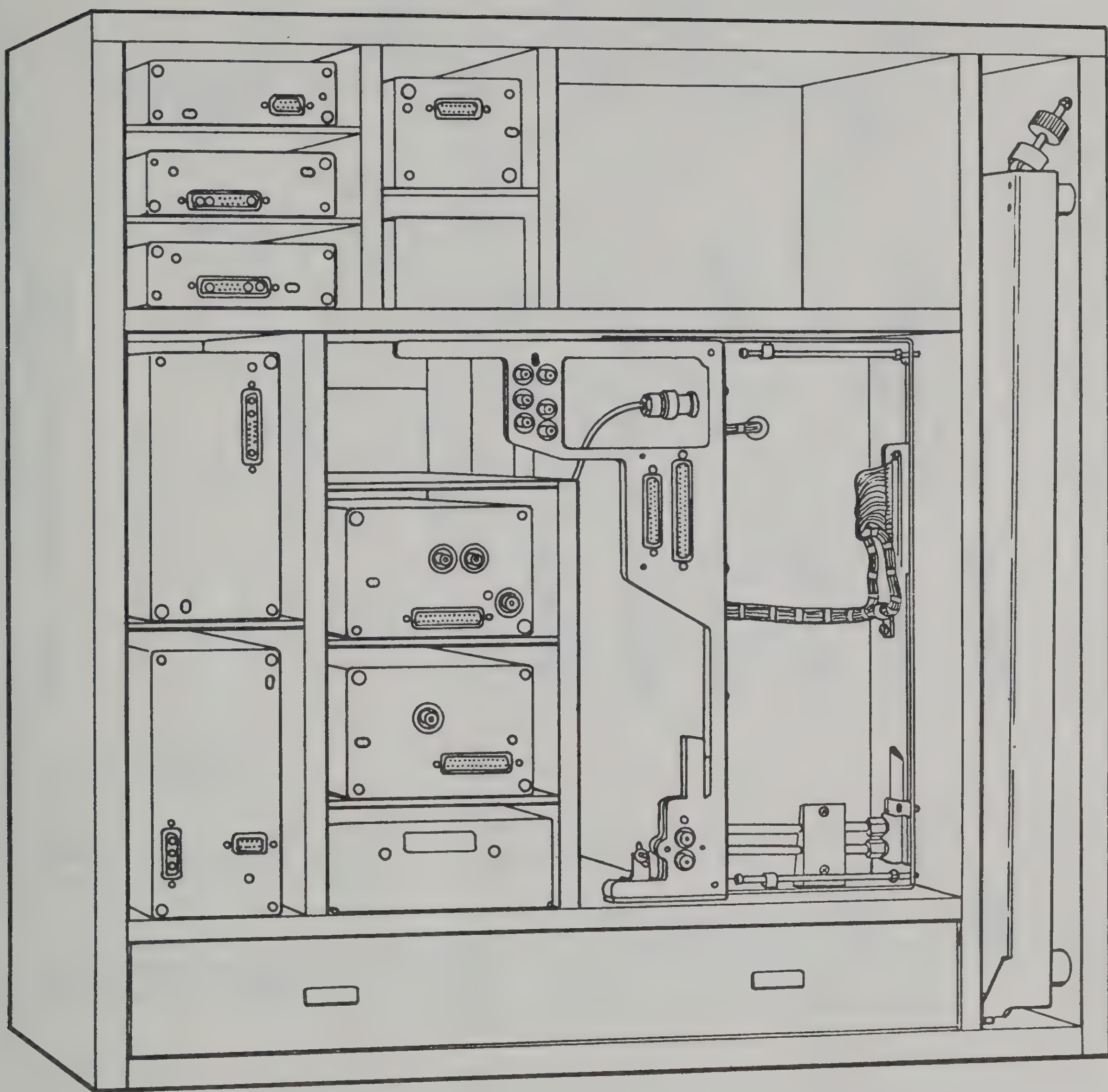
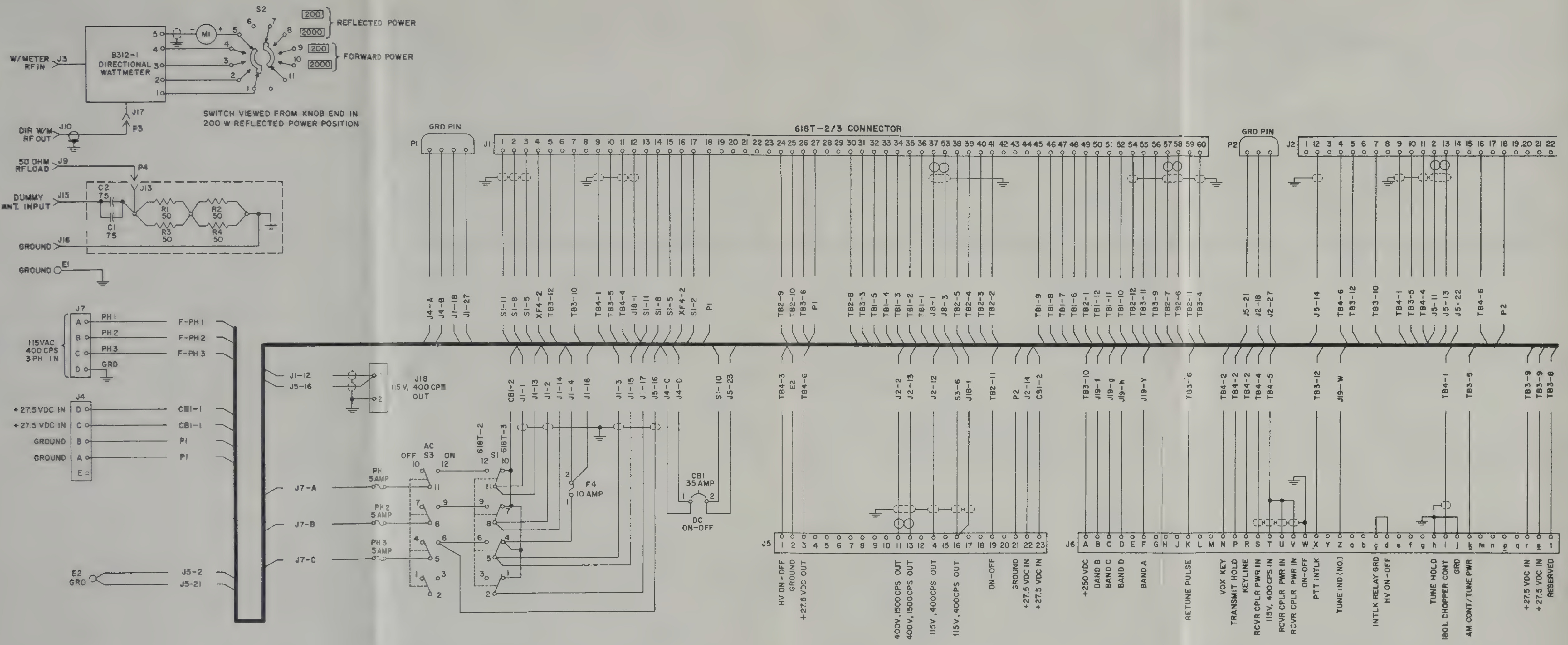


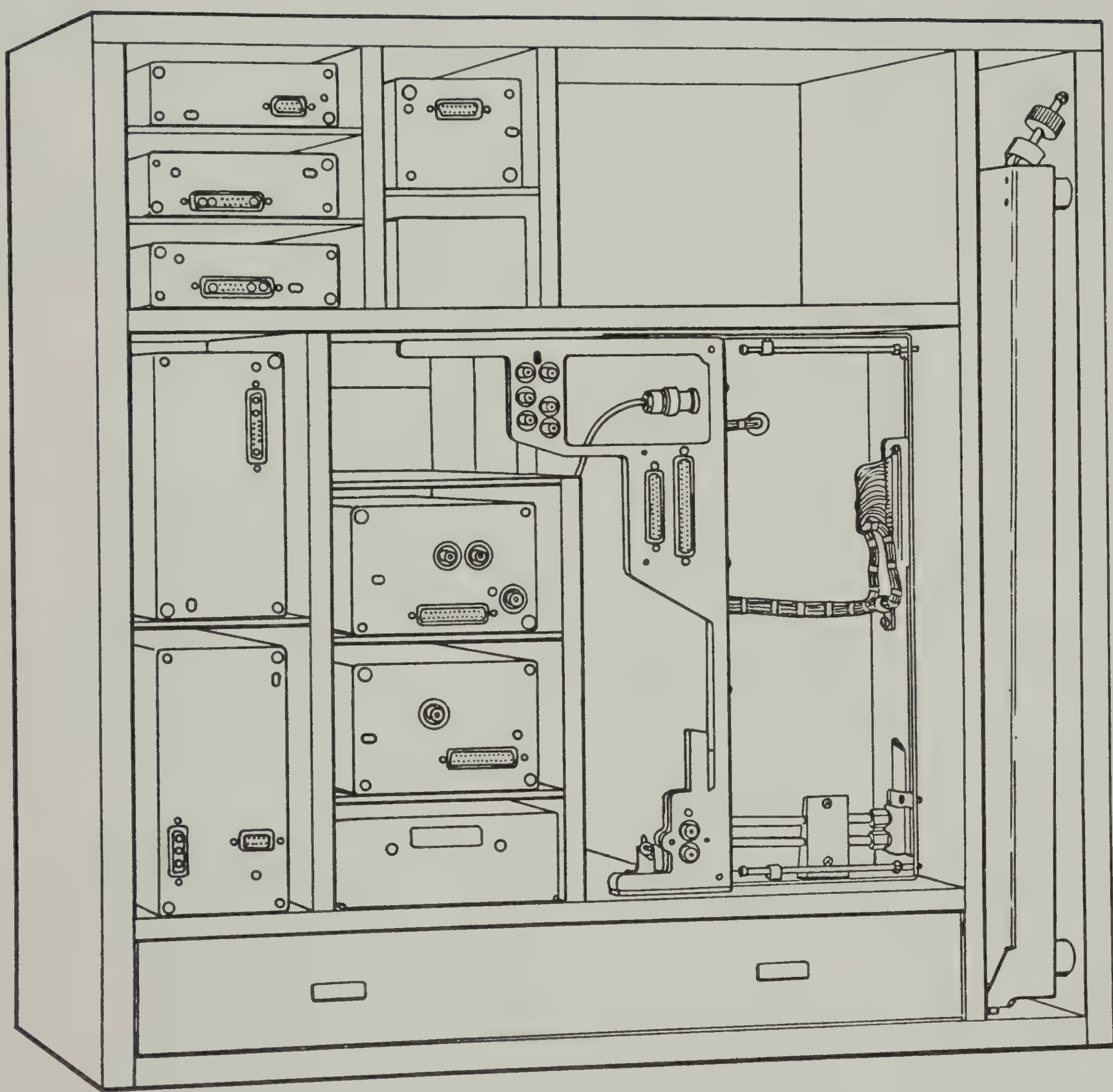
Test Harness 678P-1, Schematic Diagram
(Sheet 1 of 2)
Figure 1002



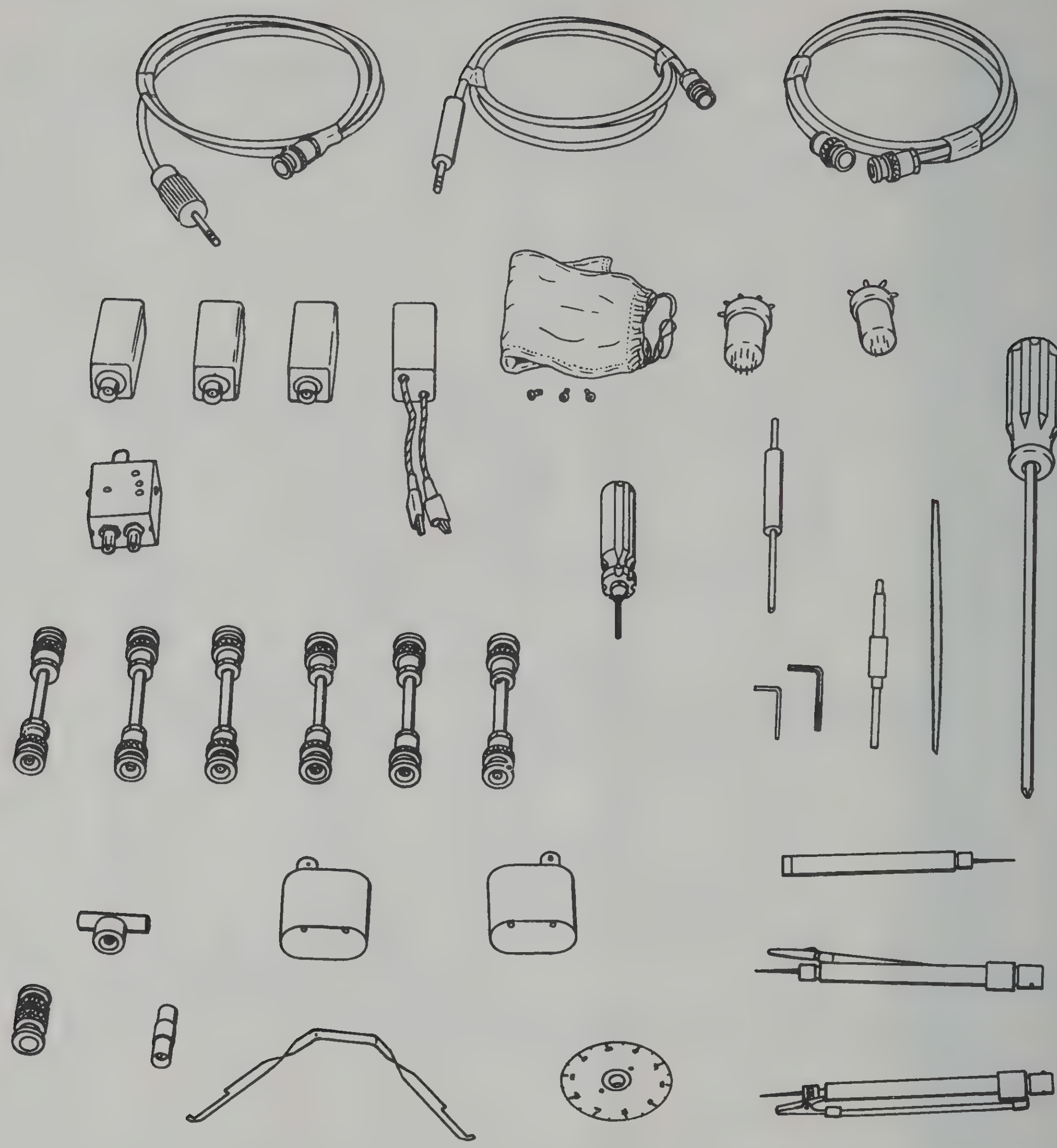
Maintenance Kit 678Y-1, Part 1
Figure 1003



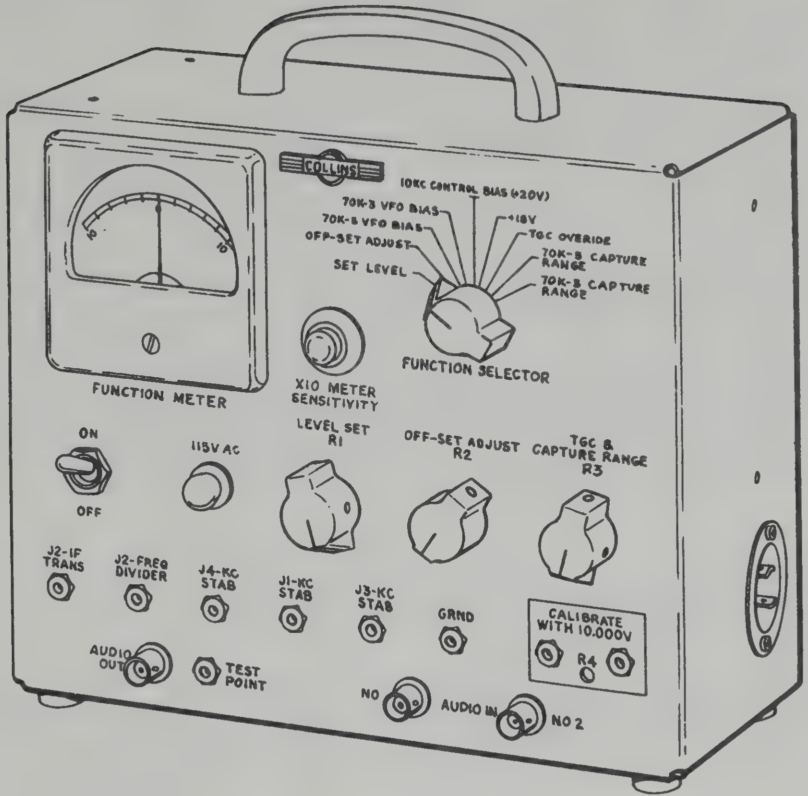
Test Harness 678P-1, Schematic Diagram
(Sheet 2 of 2)
Figure 1002



Maintenance Kit 678Y-1, Part 1
Figure 1003



Maintenance Kit 678Y-1, Part 2
Figure 1004



Function Test Set 678Z-1, Over-all View
Figure 1005

B. Connections.

Connect the 115-volt, 400-cps power cord to the receptacle on the rear of Test Harness 678P-1. Connect the GRND lead (black) to the 618T-( ) chassis.

Connect only the required test leads from 678Z-1 jacks to the points in the 618T-( ) indicated near each jack on the 678Z-1 front panel. When performing tests, connect only the leads listed in paragraph 4.D. for each particular setting of the FUNCTION SELECTOR switch. The GRND lead should remain connected at all times.

C. Calibration.

Calibrate Function Test Set 678Z-1 each time it is used as follows:

(1) Lay the 678Z-1 on its back so that the front panel is horizontal; keep in this position while performing tests.

(2) Set the FUNCTION SELECTOR switch to TGC OVERIDE and adjust the meter needle to exactly 0 by adjusting the meter zeroing screw.

(3) Set the ON-OFF switch to ON. Allow the 678Z-1 to warm up for 15 minutes.

(4) Set the FUNCTION SELECTOR switch to SET LEVEL.

(5) Set the OFF-SET ADJUST control, R2, to the middle of its rotational range, and adjust the LEVEL SET control, R1, until the meter indicates +10.

(6) In addition to this regular calibration, Function Test Set 678Z-1 should be calibrated every six months using an accurate voltmeter. To do this, set the FUNCTION SELECTOR switch to SET LEVEL, and set R1 and R2 as described above. Connect a differential voltmeter, such as a John Fluke Differential Voltmeter Model 801, between the two CALIBRATE WITH 10.000 V test points. Adjust R4 until the voltmeter indicates 10.000 ±0.001 volts d-c. Do not ground either CALIBRATE test point during this procedure. Remove the back cover of the 678Z-1. Apply a d-c voltage of 19.930 volts (as measured with the Fluke voltmeter) from the J4-KC STAB jack to ground. Set the FUNCTION SELECTOR switch to 10KC CONTROL BIAS (+20V) and adjust R25 in the 678Z-1 for a null indication on the FUNCTION METER. Replace the back cover.

D. Operation.

The following operations may be performed with the FUNCTION SELECTOR switch in each of its positions and the indicated leads connected to the 618T-( ).

NOTE: When adjusting for a meter null while the FUNCTION SELECTOR switch is in the following positions, adjust carefully until no meter movement can be detected when the X10 METER SENSITIVITY switch is depressed and released several times. Connect the 678Z-1 GRND jack to the 618T-( ) chassis whenever the 678Z-1 is used.

SET LEVEL . . . . (No leads connected.) Adjust the LEVEL SET control, R1, until the meter indicates +10. DO NOT use the meter sensitivity switch.

OFF-SET ADJUST . . . . (J1-KC STAB jack connected.) Ground TP5 in the kilocycle-frequency stabilizer module, and adjust the OFF-SET ADJUST control, R2, for an exact meter null with the X10 METER SENSITIVITY switch depressed.

70K-5 VFO BIAS . . . . (J3-KC STAB jack connected.) With TP5 grounded, adjust the VOF BIAS ADJUST control, R62 in the kilocycle-frequency stabilizer module, for an exact meter null with the X10 METER SENSITIVITY switch depressed. (To be used only with module part number 528-0112-005.)

70K-3 VFO BIAS . . . . (J1-KC STAB jack connected.) Same as preceding function; (To be used only with module part number 544-9288-005.)

NOTE: Do not attempt to check the vfo frequency until the test leads have been disconnected from J1 and J3 in the kilocycle-frequency stabilizer module.

10KC CONTROL BIAS (+20V) . . . . . . (J4-KC STAB jack connected.) Adjust the 10KC CONTROL BIAS ADJUST control, R63 in the

	kilocycle-frequency stabilizer module, for an exact meter null with the X10 METER SENSITIVITY switch depressed.
+18V	(J2-FREQ DIV jack connected.) Adjust R15 in the low-voltage power supply module for an exact meter null with the X10 METER SENSITIVITY switch depressed.
TGC OVERIDE	(J2-FREQ DIV and J2-IF TRANS jacks connected.)

CAUTION: BE CAREFUL NOT TO OVERDRIVE THE TRANSMITTER WHEN THE 678Z-1 IS BEING USED TO OVERRIDE THE TGC. ALWAYS KEEP THE 618T-( ) R-F OUTPUT VOLTAGE BELOW 72 VOLTS RMS IN AM OR 143 VOLTS IN USB OR LSB WHEN USING A TWO-TONE AUDIO INPUT. VOLTAGE IS ADJUSTABLE WITH 678Z-1 TGC & CAPTURE RANGE CONTROL, R3.

70K-5 CAPTURE RANGE	(J2-FREQ DIV and J3-KC STAB jacks connected.) See instructions for kilocycle-frequency stabilizer capture range check, in the testing section.
70K-3 CAPTURE RANGE	(J2-FREQ DIV and J1-KC STAB jacks connected.) Same as preceding function.

E. Dummy Microphone.

To use the dummy microphone, connect the audio oscillator to either AUDIO IN NO. 1 or NO. 2. Connect the AUDIO OUT jack to the MIKE jack on Test Harness 678P-1 using the audio cable supplied in Maintenance Kit 678Y-1. Audio input to the 618T-( ) may be measured at the TEST POINT jack.

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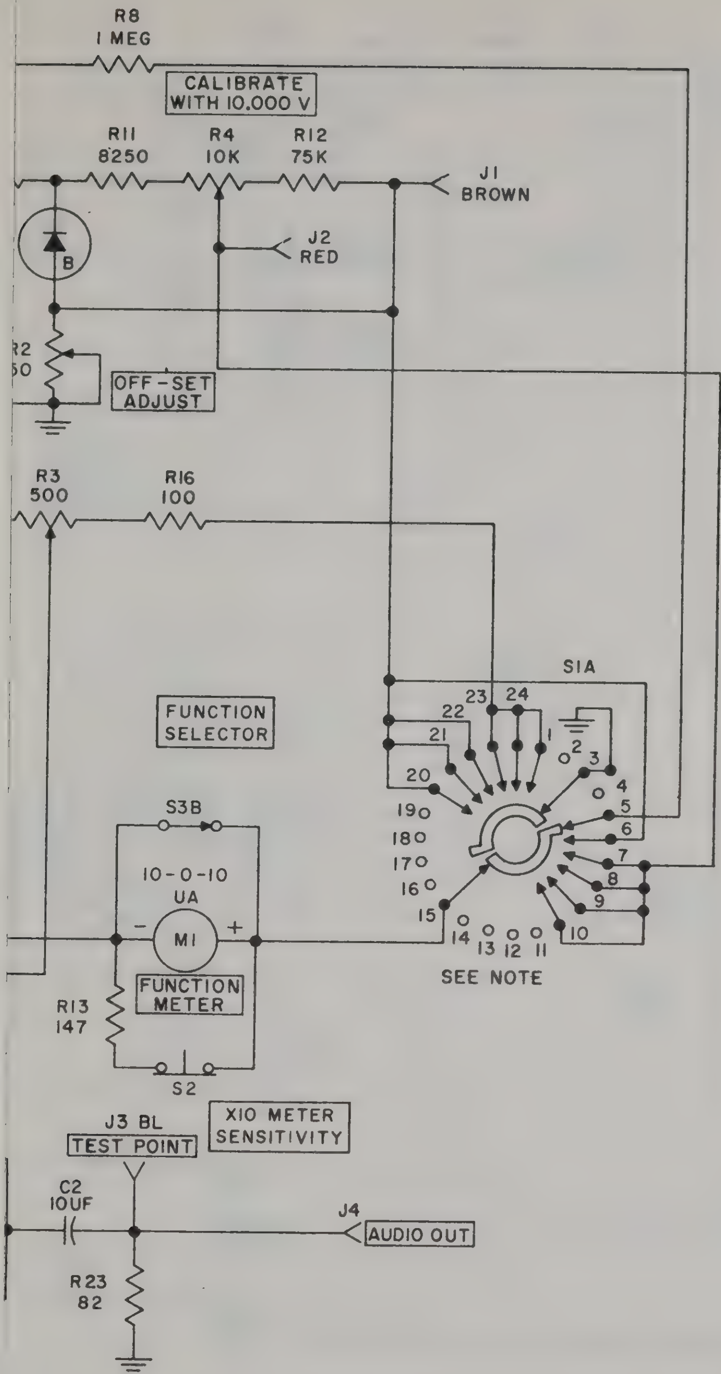

SILKSCREEN:
SWITCH POSITIONS
(CCW TO CW)

SET LEVEL
OFF-SET ADJUST
70K-5 VFO BIAS
70K-3 VFO BIAS
10KC CONTROL BIAS (+20V)
+18V
TGC OVERIDE
70K-5 CAPTURE RANGE
70K-3 CAPTURE RANGE

Function Test Set 678Z-1, Schematic Diagram
Figure 1006

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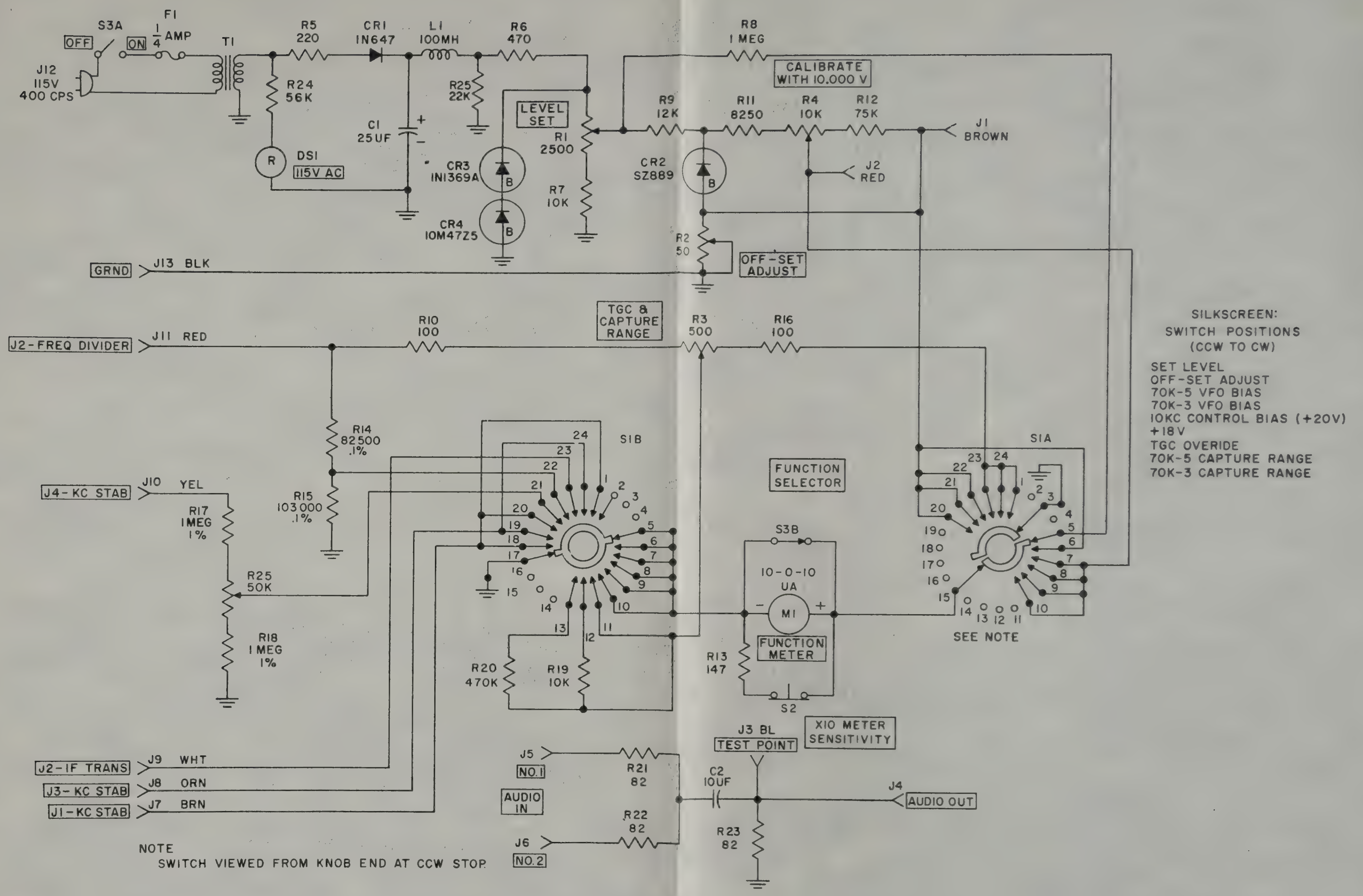

Function Test Set 678Z-1, Schematic Diagram
Figure 1006

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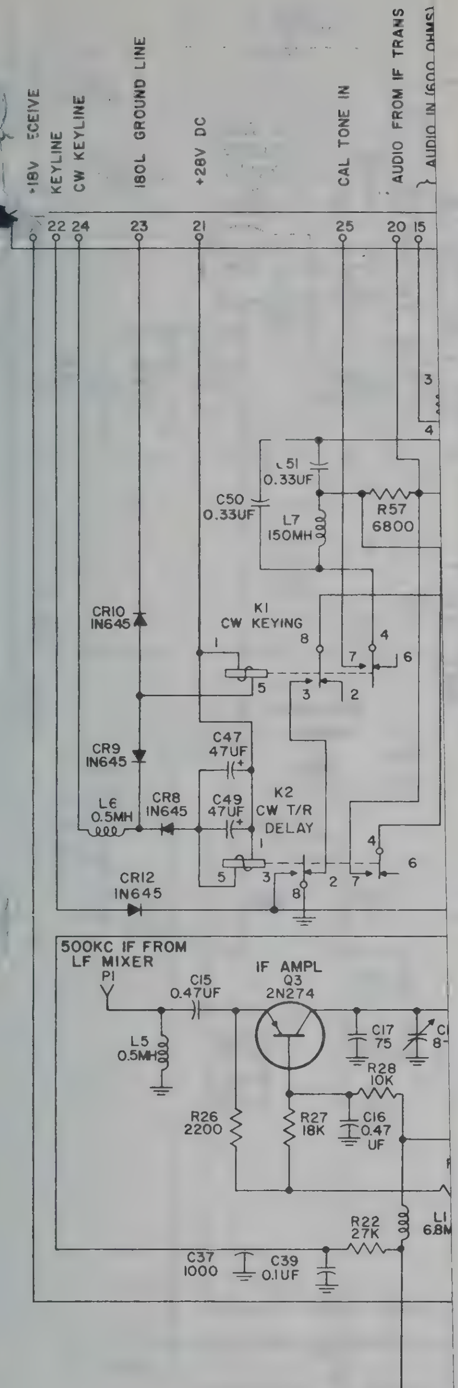
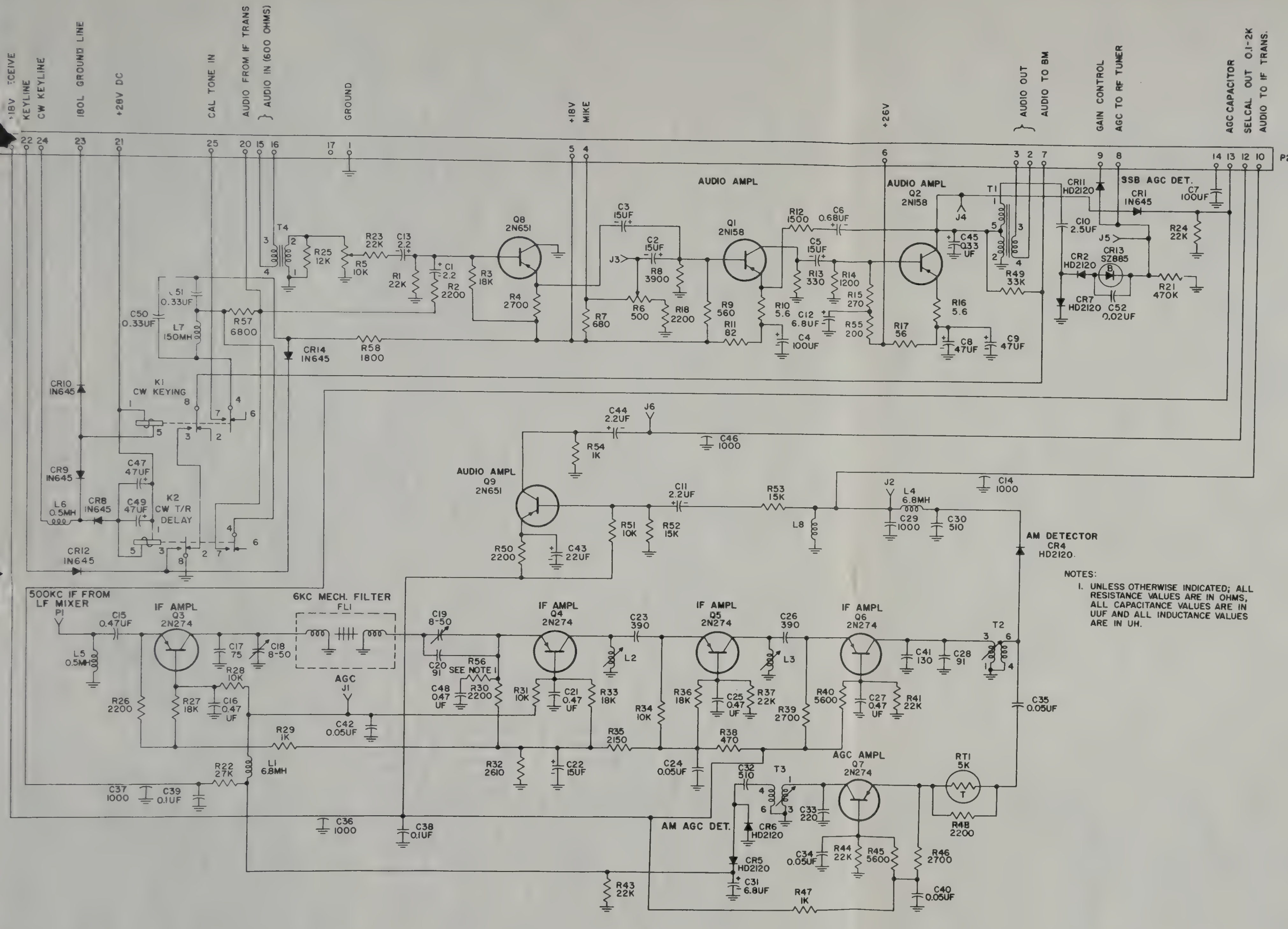
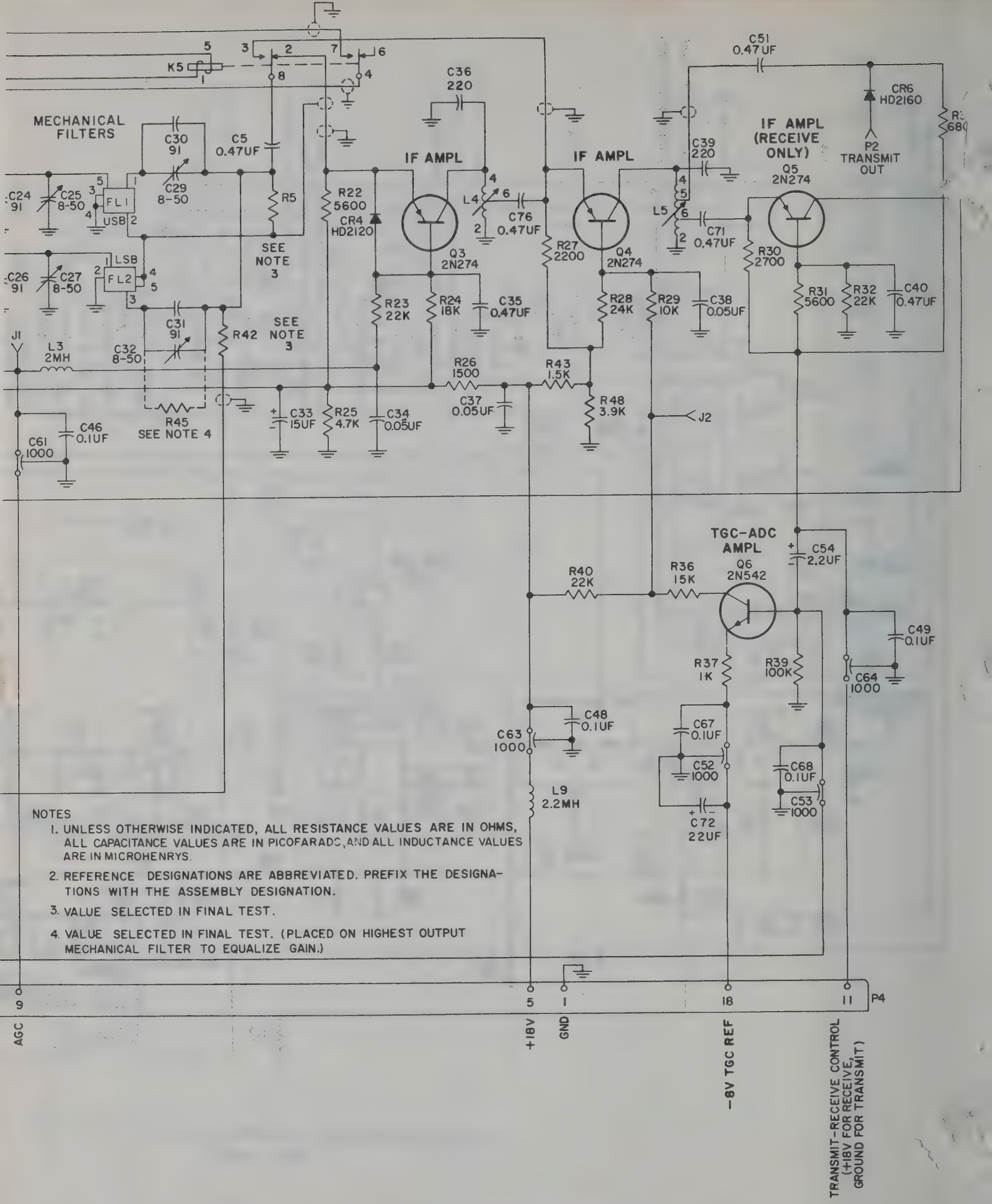


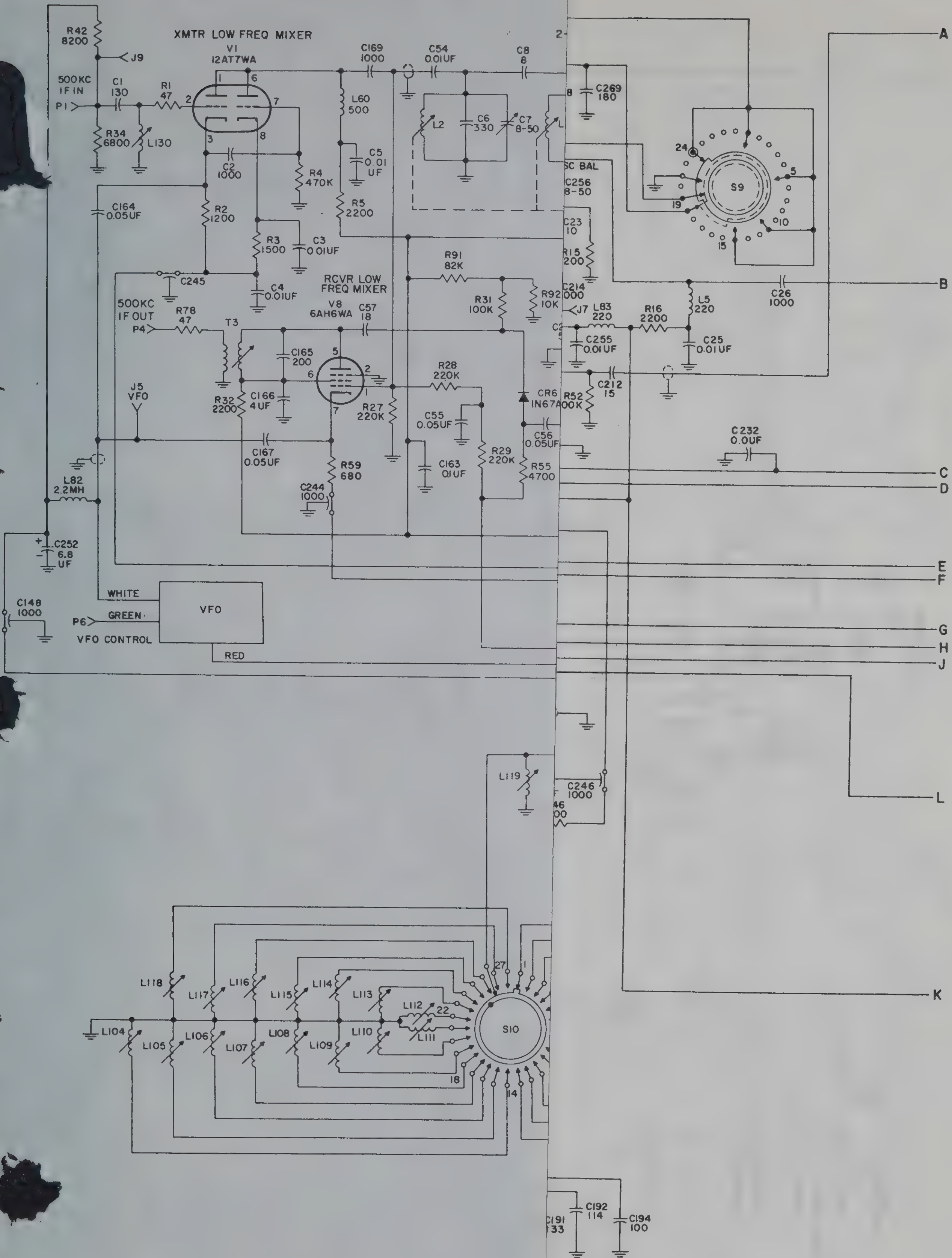
+18V RECEIVE
KEYLINE
CW KEYLINE
180L GROUND LINE
+28V DC
CAL TONE IN
AUDIO FROM IF TRANS
AUDIO IN (600 OHMS)
22 24 23 21 25 20 15
C51 0.33UF
C50 0.33UF
L7 150MH
R57 6800
K1 CW KEYING
CR10 1N645
CR9 1N645
C47 47UF
C49 47UF
K2 CW T/R DELAY
L6 0.5MH
CR8 1N645
CR12 1N645
500KC IF FROM LF MIXER
P1
C15 0.47UF
IF AMPL Q3 2N274
L5 0.5MH
C17 75
R28 10K
R26 2200
R27 18K
C16 0.47 UF
R22 27K
L1 6.8M
C37 1000
C39 0.1UF



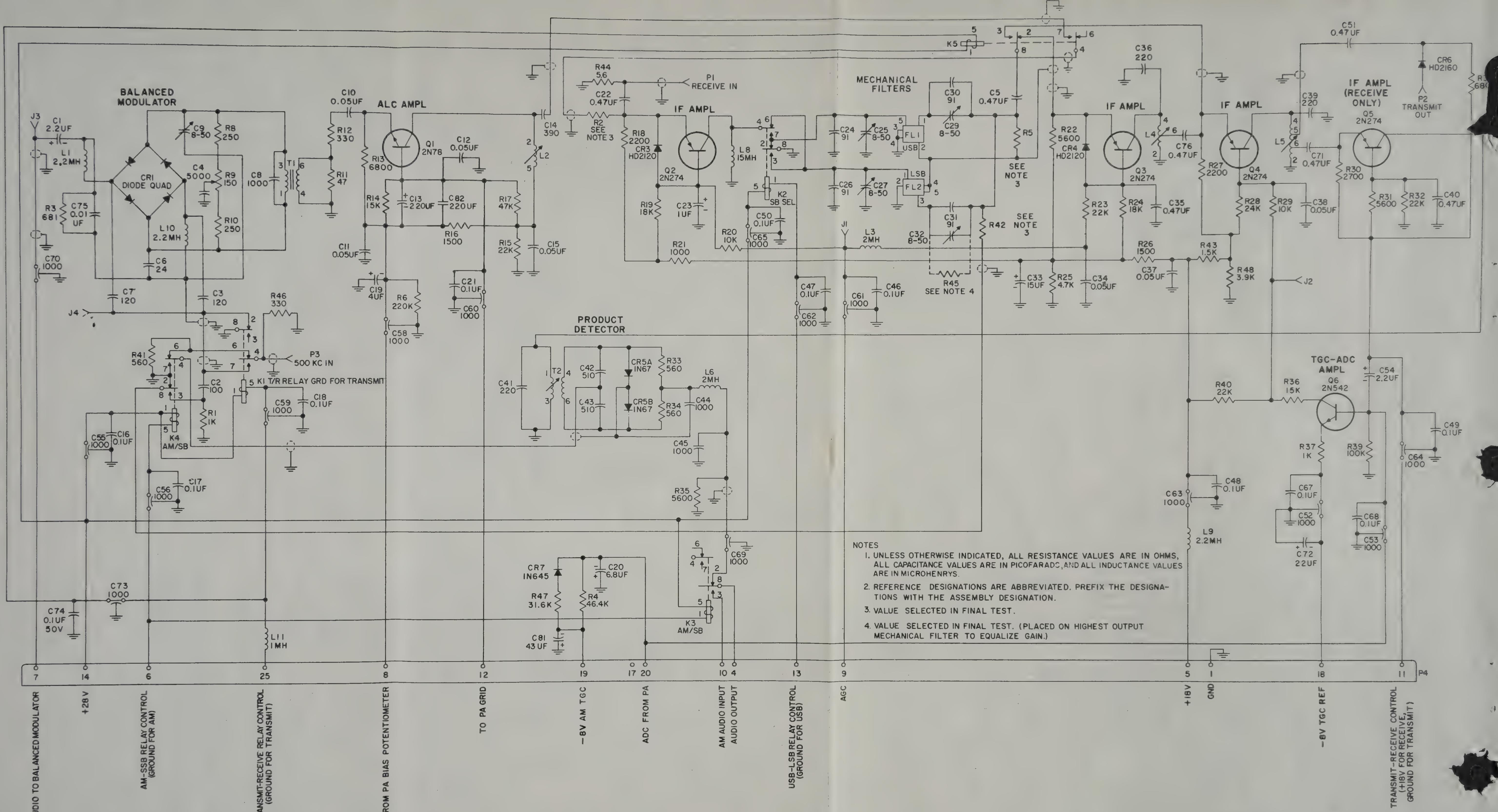
AM/Audio Amplifier Module, Schematic Diagram
Figure 1101



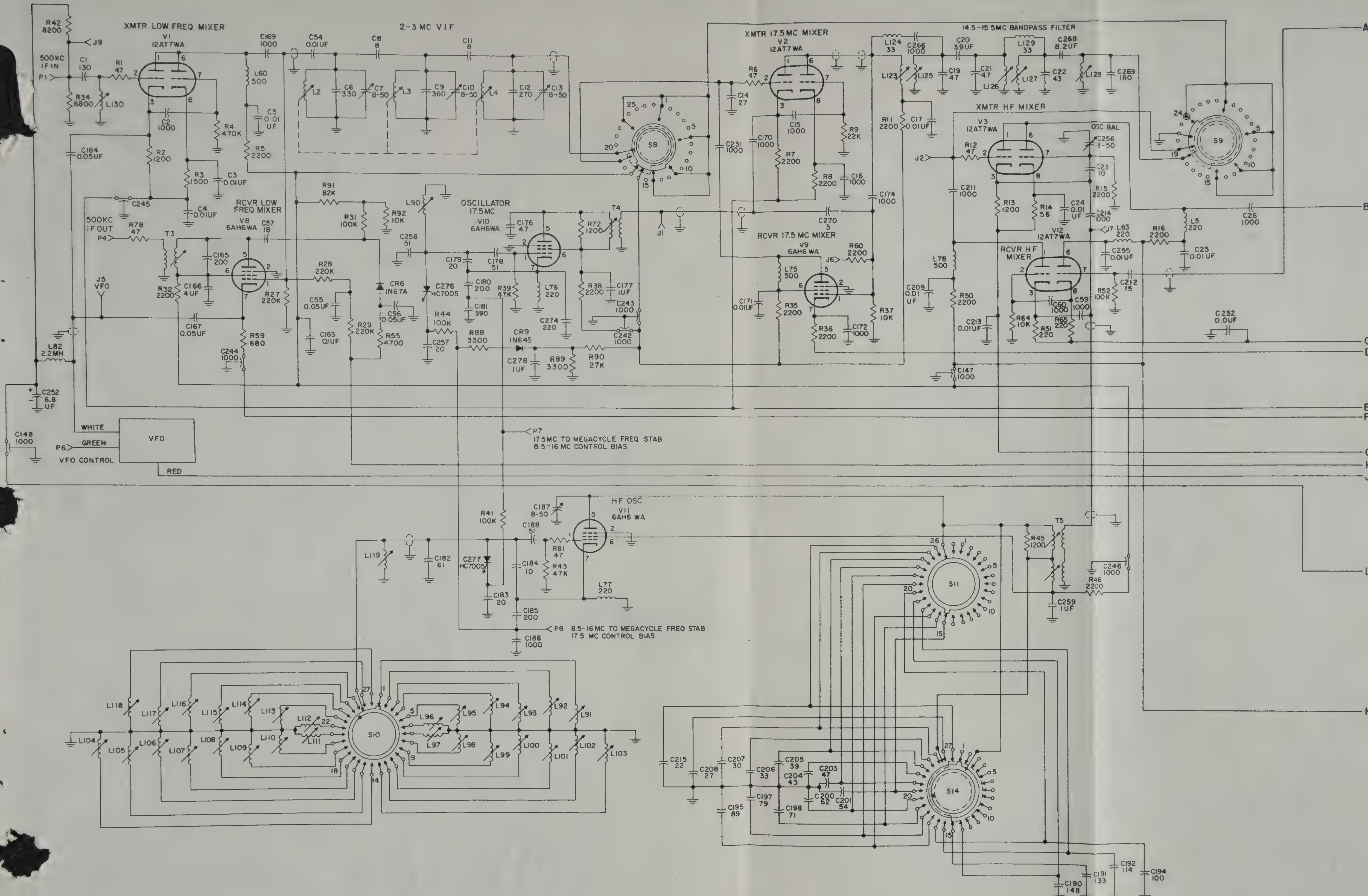
I-F Translator Module, Schematic Diagram
Figure 1102



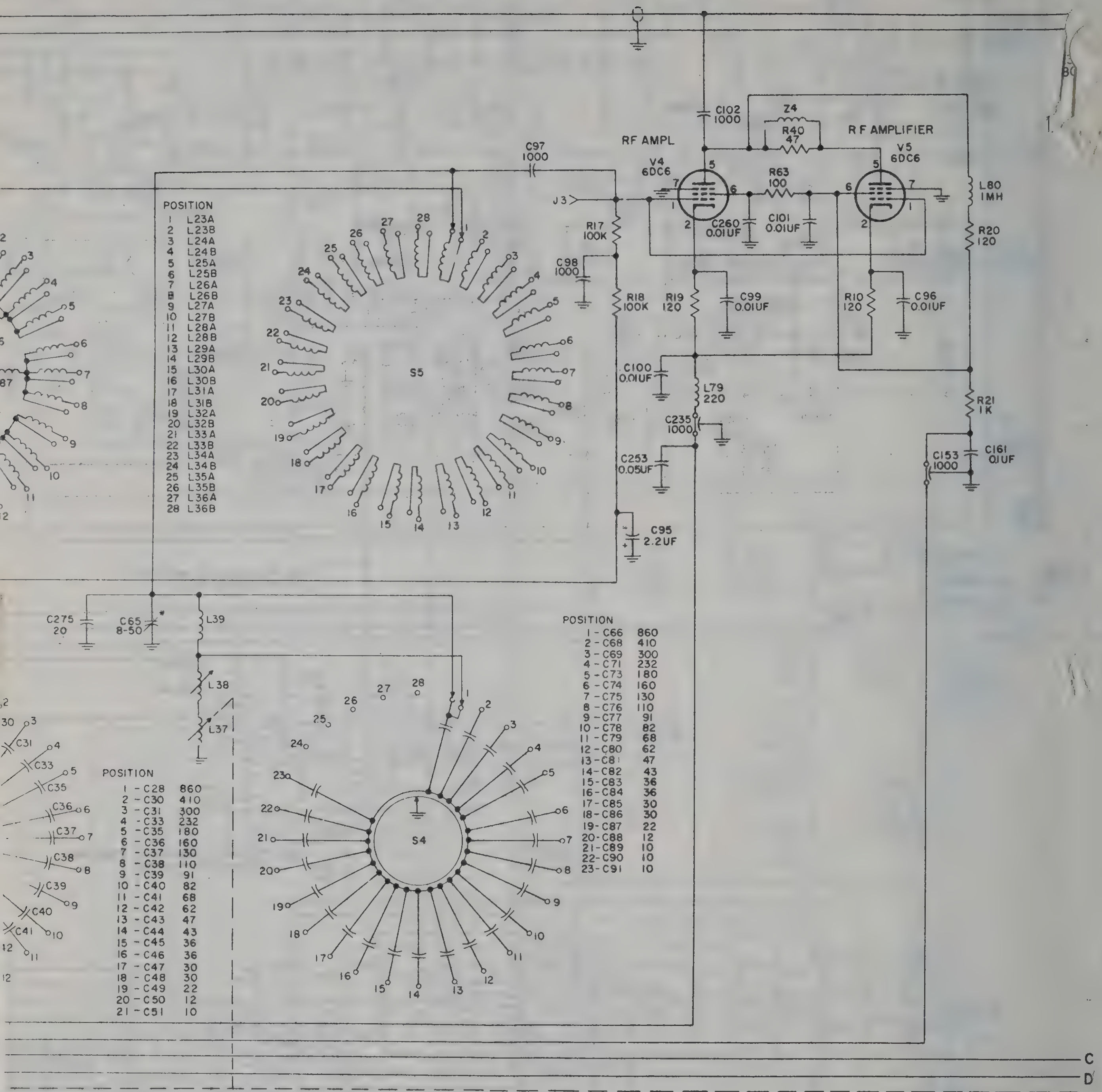
anslator Module, Schematic Diagram
(Sheet 1 of 3)
Figure 1103



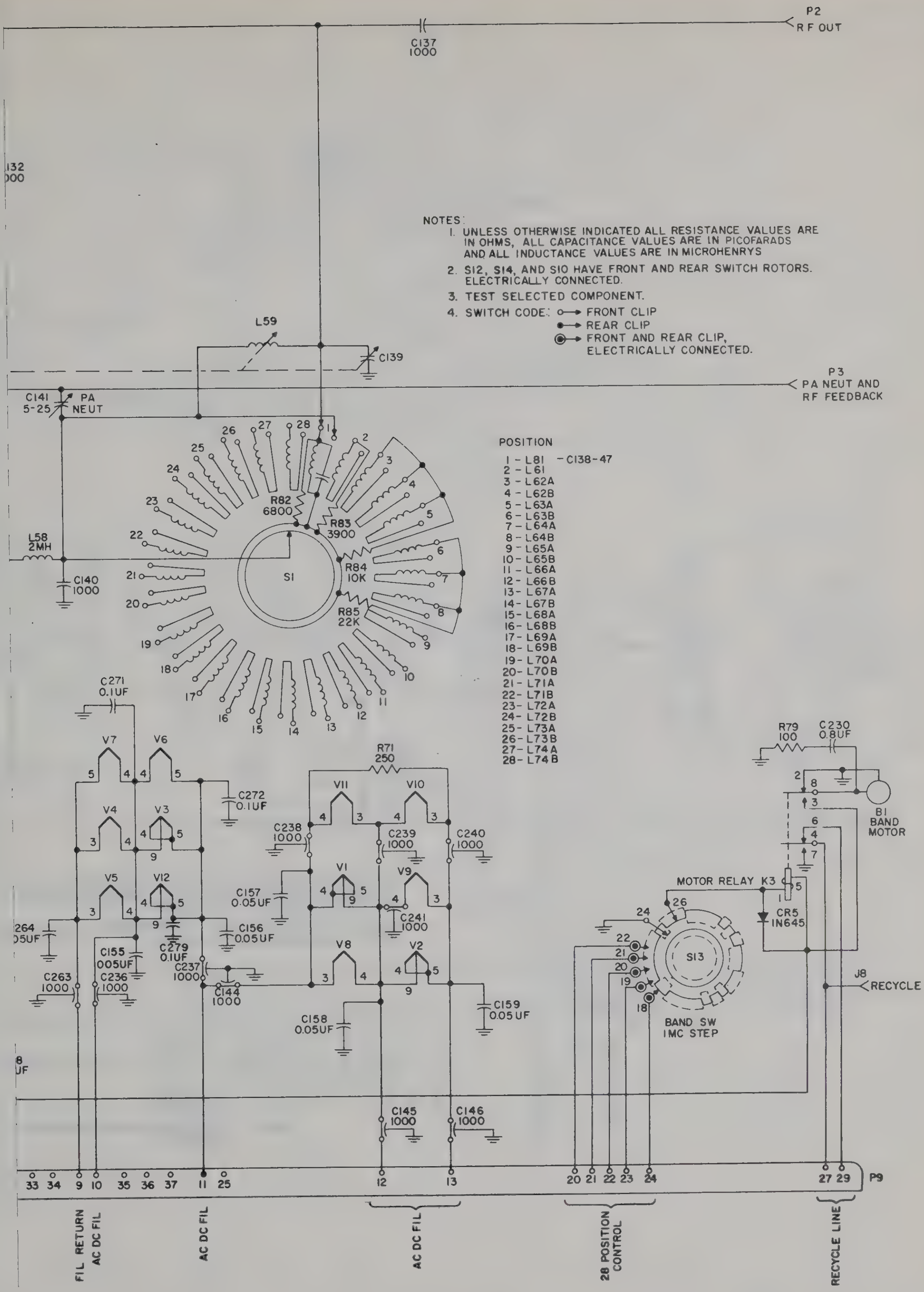
I-F Translator Module, Schematic Diagram
Figure 1102



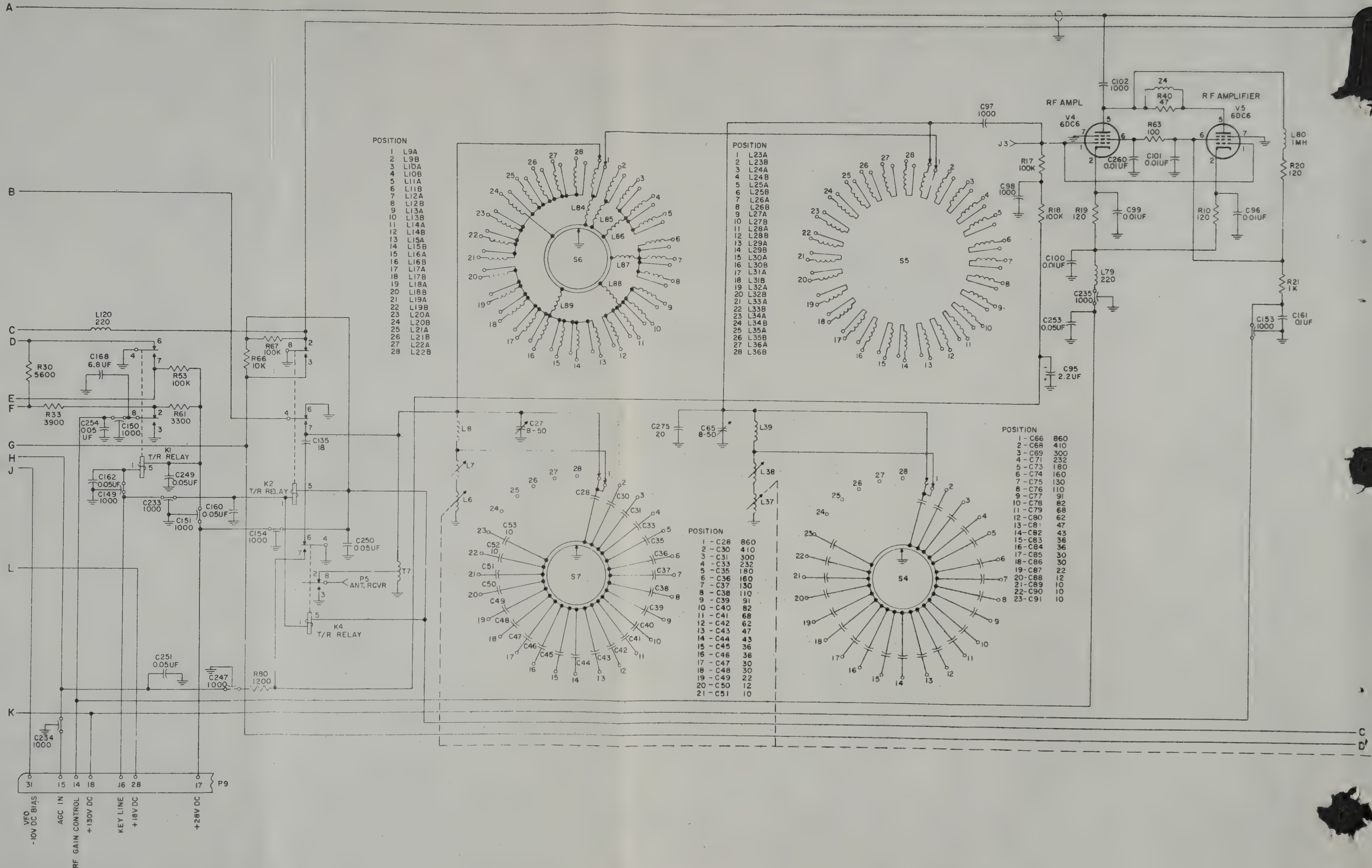
R-F Translator Module, Schematic Diagram
(Sheet 1 of 3)
Figure 1103



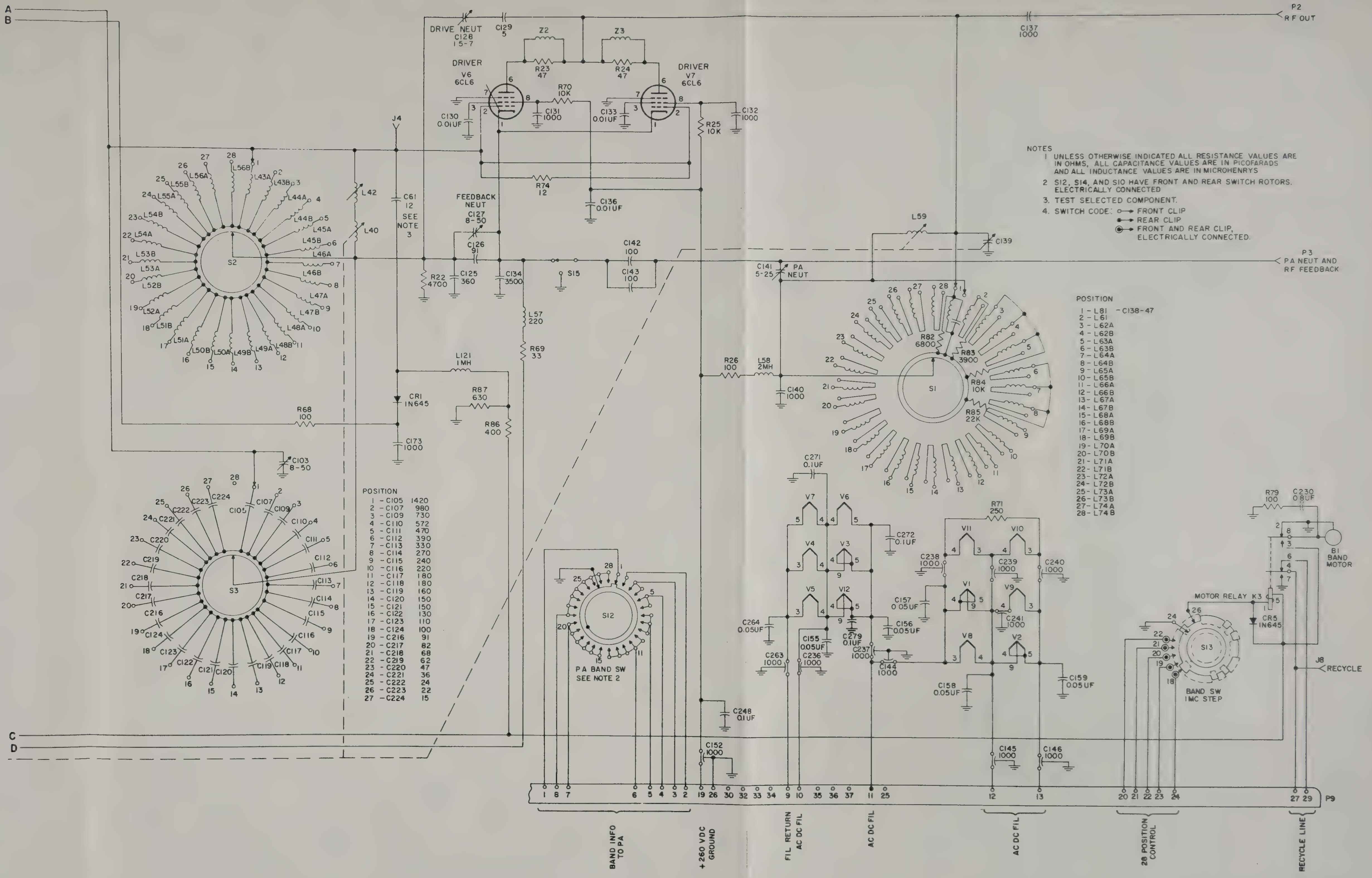
R-F Translator Module, Schematic Diagram
(Sheet 2 of 3)
Figure 1103



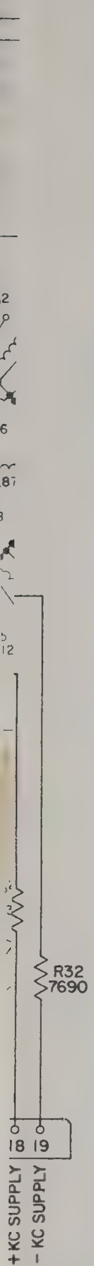
R-F Translator Module, Schematic Diagram
(Sheet 3 of 3)
Figure 1103



R-F Translator Module, Schematic Diagram
(Sheet 2 of 3)
Figure 1103



R-F Translator Module, Schematic Diagram
(Sheet 3 of 3)
Figure 1103



.gram

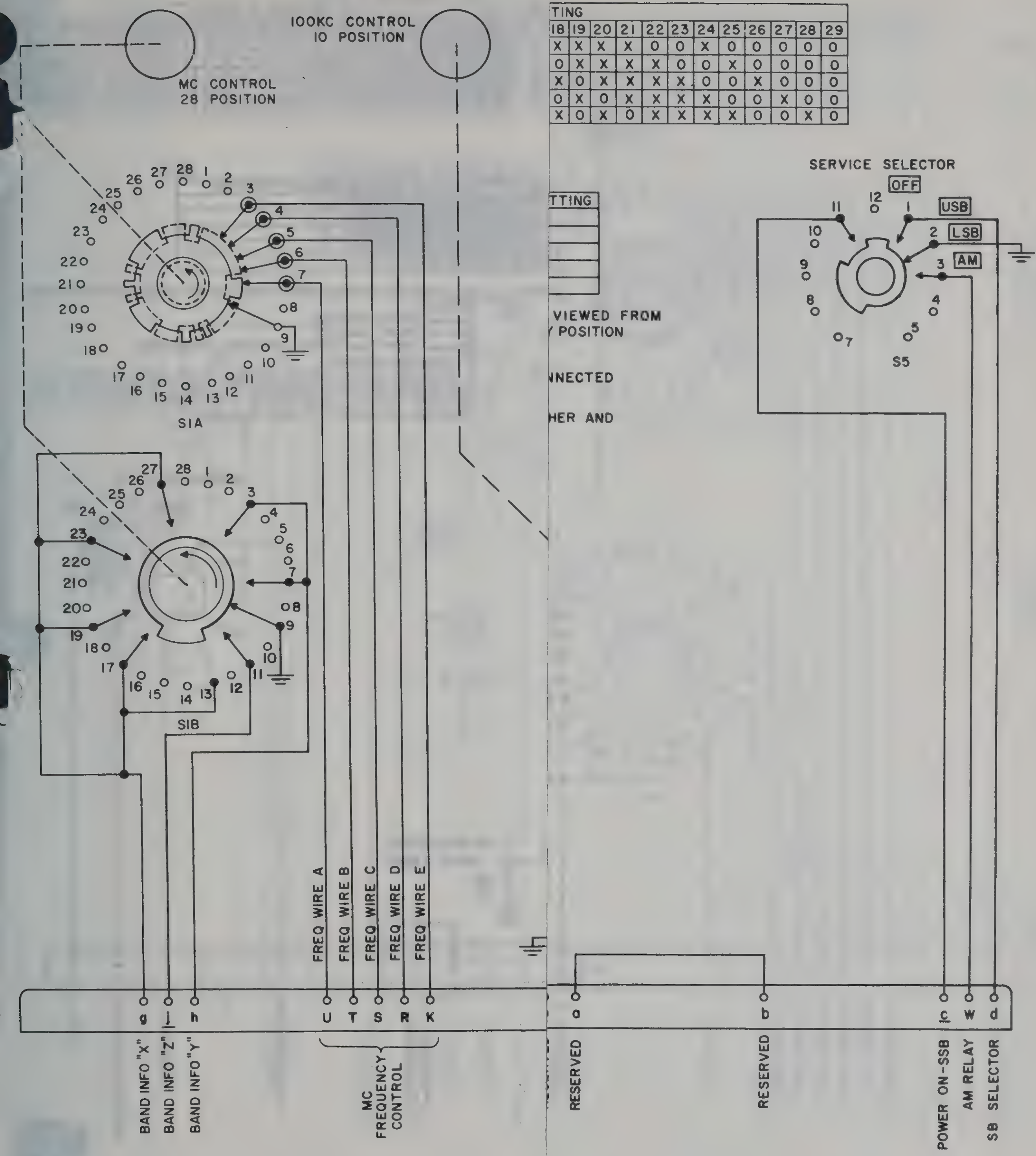
TING											
18	19	20	21	22	23	24	25	26	27	28	29
X	X	X	X	O	O	X	O	O	O	O	O
O	X	X	X	X	O	O	X	O	O	O	O
X	O	X	X	X	X	O	O	X	O	O	O
O	X	O	X	X	X	X	O	O	X	O	O
X	O	X	O	X	X	X	X	O	O	X	O

TTING

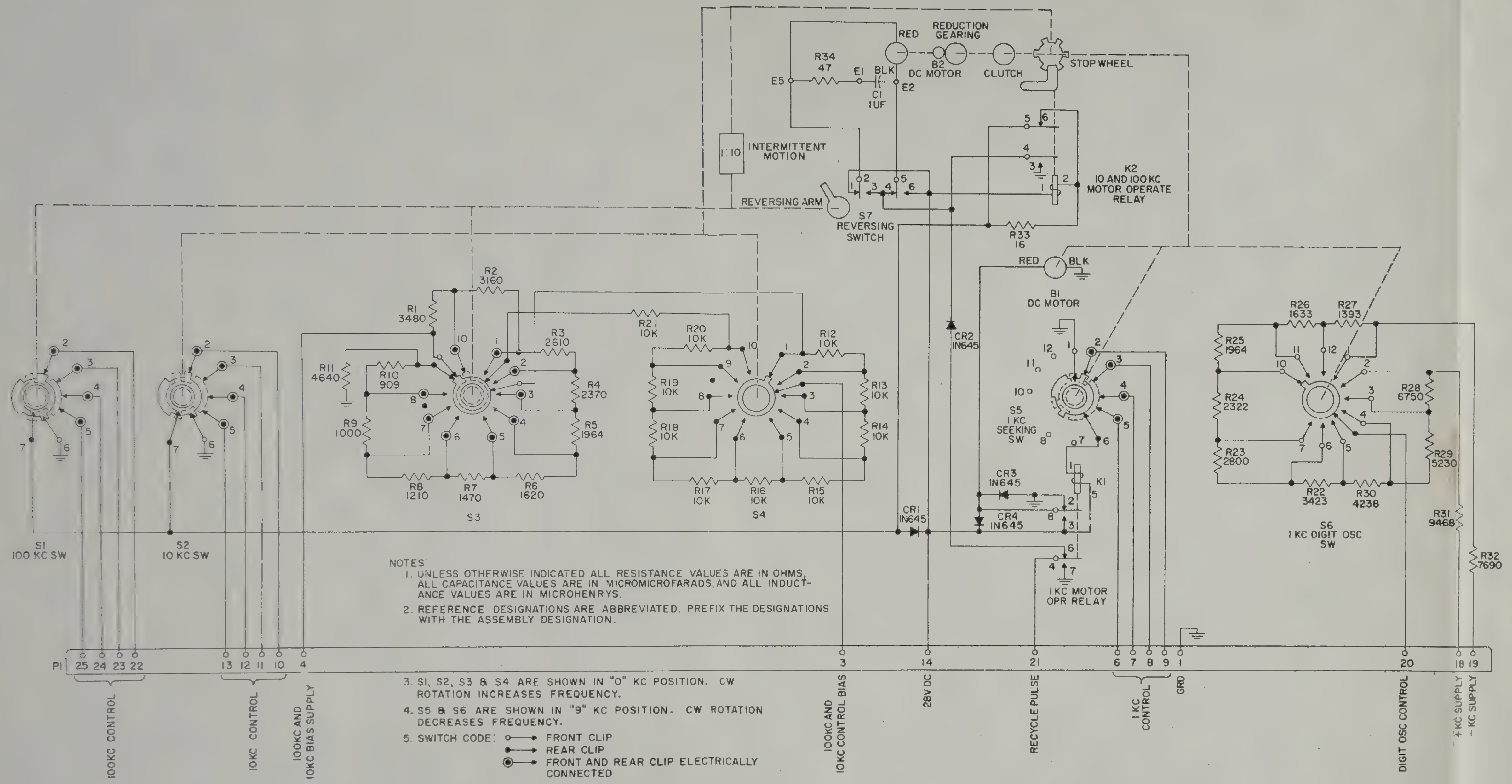
VIEWED FROM
POSITION

NNECTED

HER AND



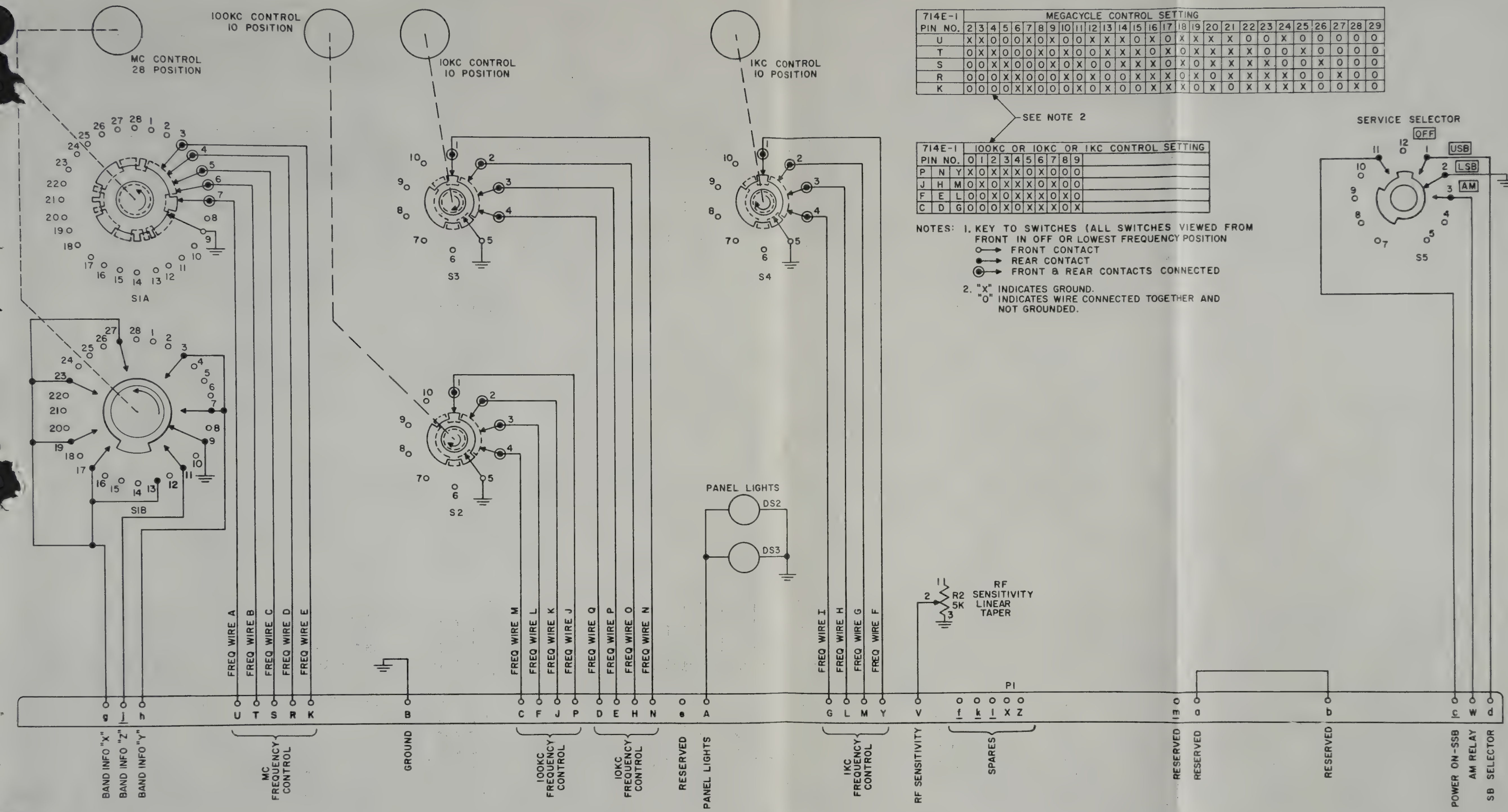
Control Unit 714E-1, Schematic Diagram
Figure 1105



NOTES:

1. UNLESS OTHERWISE INDICATED ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS, AND ALL INDUCTANCE VALUES ARE IN MICROHENRYS.
2. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH THE ASSEMBLY DESIGNATION.
3. S1, S2, S3 & S4 ARE SHOWN IN "0" KC POSITION. CW ROTATION INCREASES FREQUENCY.
4. S5 & S6 ARE SHOWN IN "9" KC POSITION. CW ROTATION DECREASES FREQUENCY.
5. SWITCH CODE: FRONT CLIP; REAR CLIP; FRONT AND REAR CLIP ELECTRICALLY CONNECTED

Autopositioner Submodule, Schematic Diagram
Figure 1104



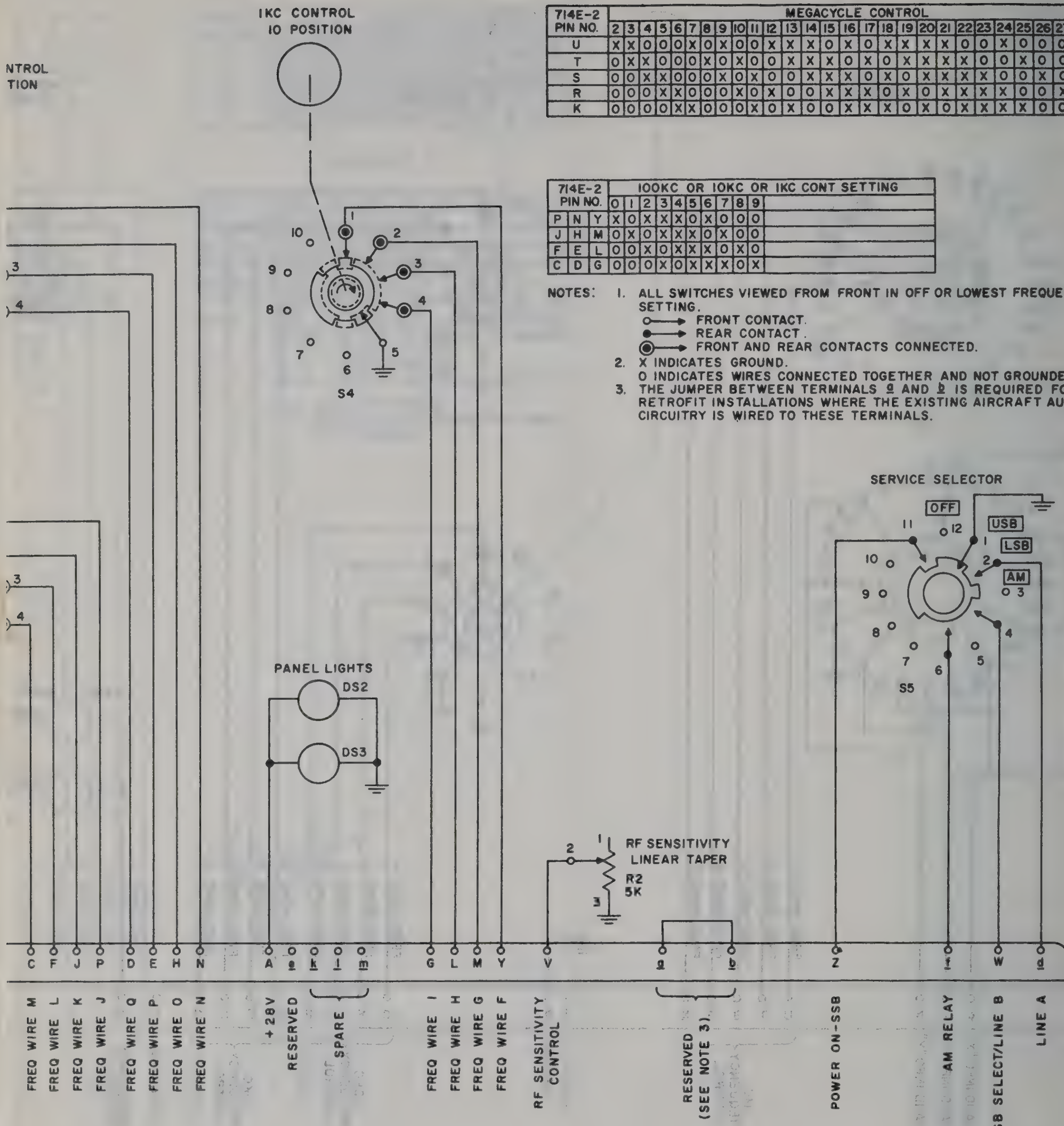
714E-1	MEGACYCLE CONTROL SETTING																											
PIN NO.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
U	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O	O	O	O
T	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O	O	O
S	O	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O	O
R	O	O	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O
K	O	O	O	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O

SEE NOTE 2

714E-1			100KC OR 10KC OR 1KC CONTROL SETTING									
PIN NO.			0	1	2	3	4	5	6	7	8	9
P	N	Y	X	O	X	X	X	O	X	O	O	O
J	H	M	O	X	O	X	X	X	O	X	O	O
F	E	L	O	O	X	O	X	X	X	O	X	O
C	D	G	O	O	O	X	O	X	X	X	O	X

NOTES:
1. KEY TO SWITCHES (ALL SWITCHES VIEWED FROM FRONT IN OFF OR LOWEST FREQUENCY POSITION
   FRONT CONTACT
   REAR CONTACT
   FRONT & REAR CONTACTS CONNECTED
2. "X" INDICATES GROUND.
   "O" INDICATES WIRE CONNECTED TOGETHER AND NOT GROUNDED.

Control Unit 714E-1, Schematic Diagram
Figure 1105



714E-2 PIN NO.	MEGACYCLE CONTROL																										
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
U	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O	O	O
T	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O	O
S	O	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O
R	O	O	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O
K	O	O	O	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X

714E-2 PIN NO.			100KC OR 10KC OR 1KC CONT SETTING									
			0	1	2	3	4	5	6	7	8	9
P	N	Y	X	O	X	X	X	O	X	O	O	O
J	H	M	O	X	O	X	X	X	O	X	O	O
F	E	L	O	O	X	O	X	X	X	O	X	O
C	D	G	O	O	O	X	O	X	X	X	O	X

NOTES:

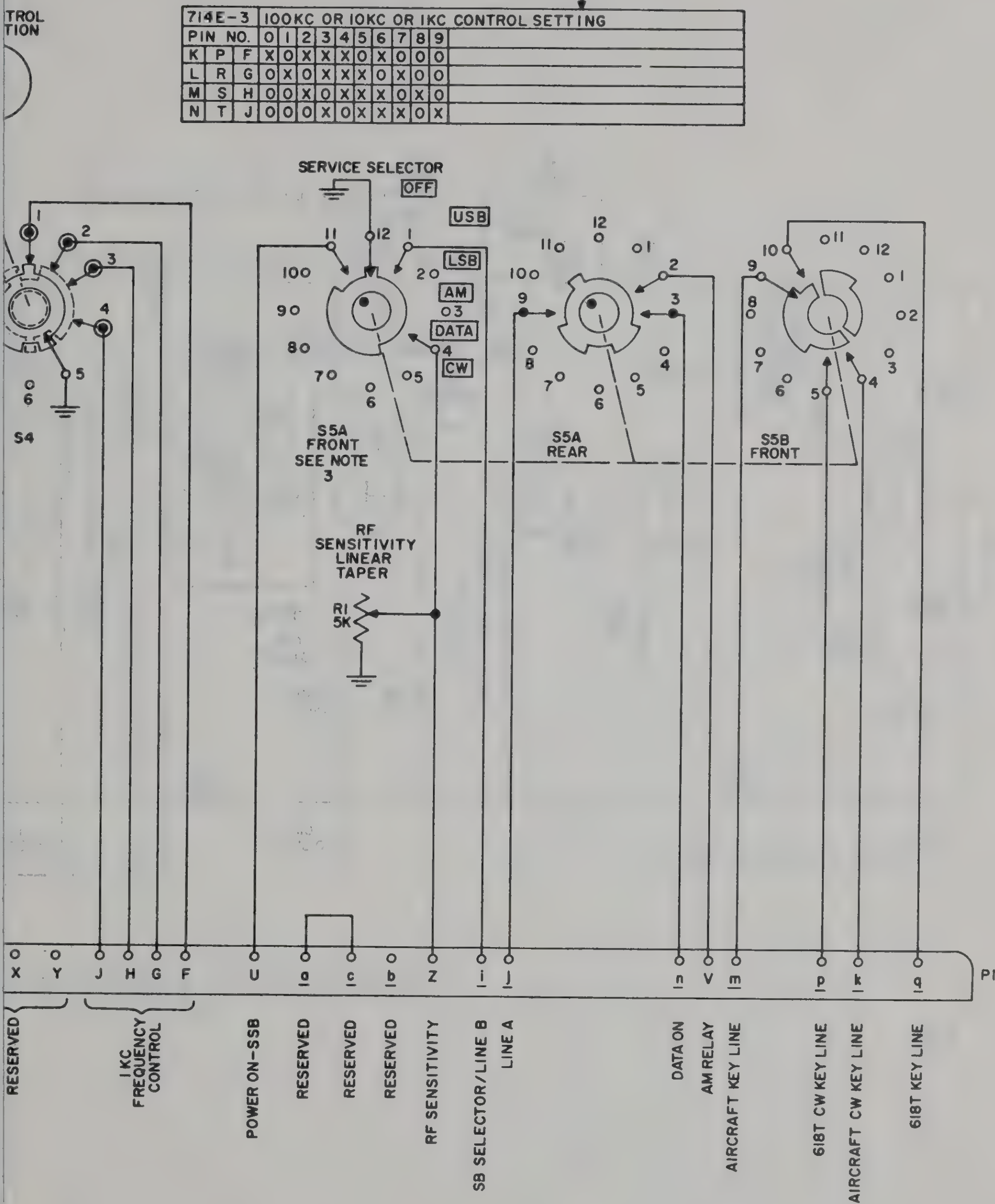
1. ALL SWITCHES VIEWED FROM FRONT IN OFF OR LOWEST FREQUENCY SETTING.
   - FRONT CONTACT.
   - REAR CONTACT.
   - FRONT AND REAR CONTACTS CONNECTED.
2. X INDICATES GROUND.
   O INDICATES WIRES CONNECTED TOGETHER AND NOT GROUNDED.
3. THE JUMPER BETWEEN TERMINALS a AND b IS REQUIRED FOR RETROFIT INSTALLATIONS WHERE THE EXISTING AIRCRAFT AUDIO CIRCUITRY IS WIRED TO THESE TERMINALS.

Control Unit 714E-2, Schematic Diagram
Figure 1106

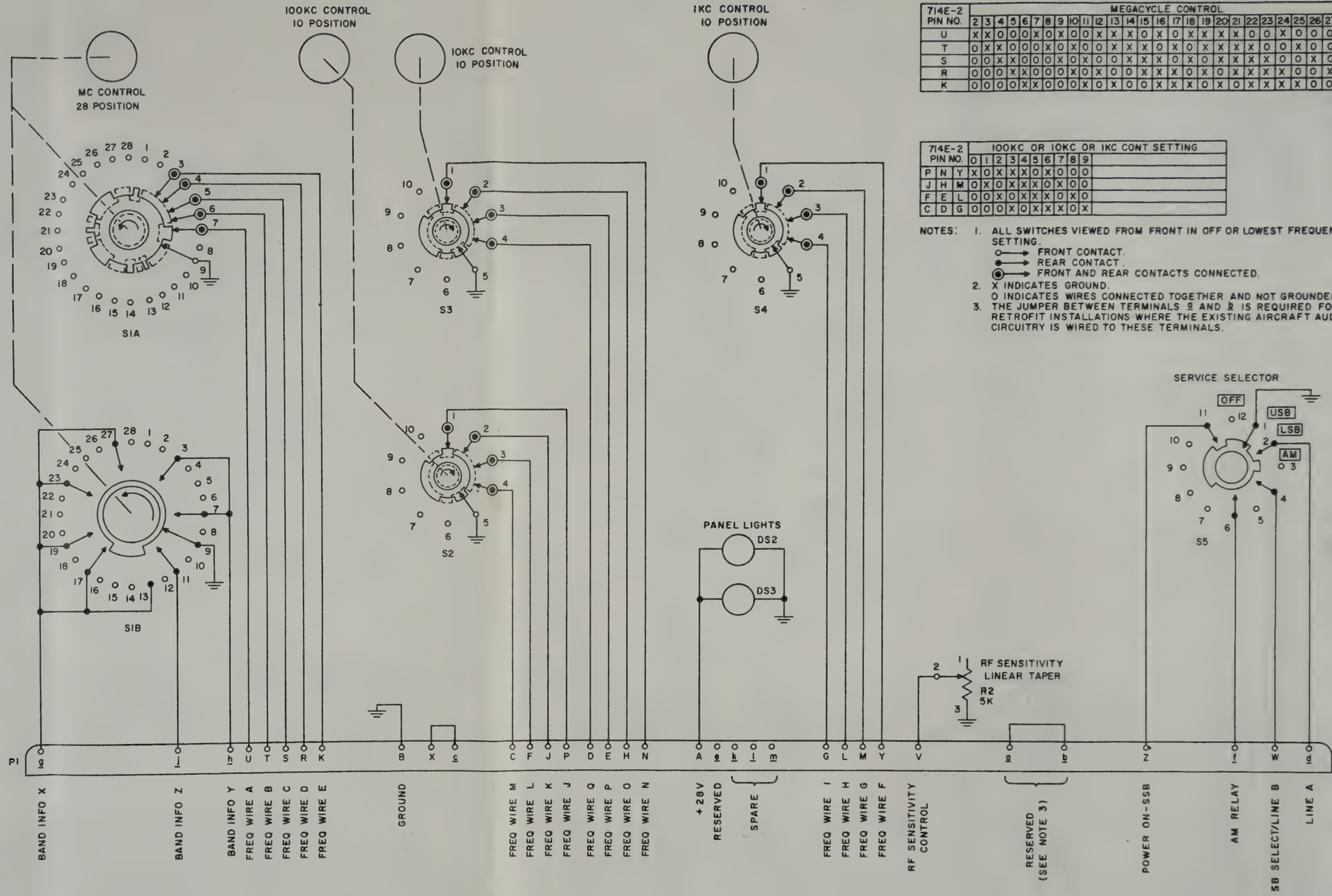
714E-3	MEGACYCLE CONTROL SETTING																											
PIN NO.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
A	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O	O	O	O
B	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O	O	O
C	O	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O	O
D	O	O	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O
E	O	O	O	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O

SEE NOTE 2

714E-3			100KC OR 10KC OR 1KC CONTROL SETTING									
PIN NO.			0	1	2	3	4	5	6	7	8	9
K	P	F	X	O	X	X	X	O	X	O	O	O
L	R	G	O	X	O	X	X	X	O	X	O	O
M	S	H	O	O	X	O	X	X	X	O	X	O
N	T	J	O	O	O	X	O	X	X	X	O	X



Control Unit 714E-3, Schematic Diagram
Figure 1107



714E-2 PIN NO.	MEGACYCLE CONTROL																											
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	[illegible]
U	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O	O	O	[illegible]
T	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O	O	O
S	O	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O	O
R	O	O	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O
K	O	O	O	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	[illegible]

714E-2 PIN NO.			100KC OR 10KC OR 1KC CONT SETTING									
			0	1	2	3	4	5	6	7	8	9
P	N	Y	X	O	X	X	X	O	X	O	O	O
J	H	M	O	X	O	X	X	X	O	X	O	O
F	E	L	O	O	X	O	X	X	X	O	X	O
C	D	G	O	O	O	X	O	X	X	X	O	X

NOTES:

1. ALL SWITCHES VIEWED FROM FRONT IN OFF OR LOWEST FREQUENCY SETTING.
   FRONT CONTACT.
   REAR CONTACT.
   FRONT AND REAR CONTACTS CONNECTED.
2. X INDICATES GROUND.
   O INDICATES WIRES CONNECTED TOGETHER AND NOT GROUNDED.
3. THE JUMPER BETWEEN TERMINALS a AND b IS REQUIRED FOR RETROFIT INSTALLATIONS WHERE THE EXISTING AIRCRAFT AUDIO CIRCUITRY IS WIRED TO THESE TERMINALS.

Control Unit 714E-2, Schematic Diagram
Figure 1106

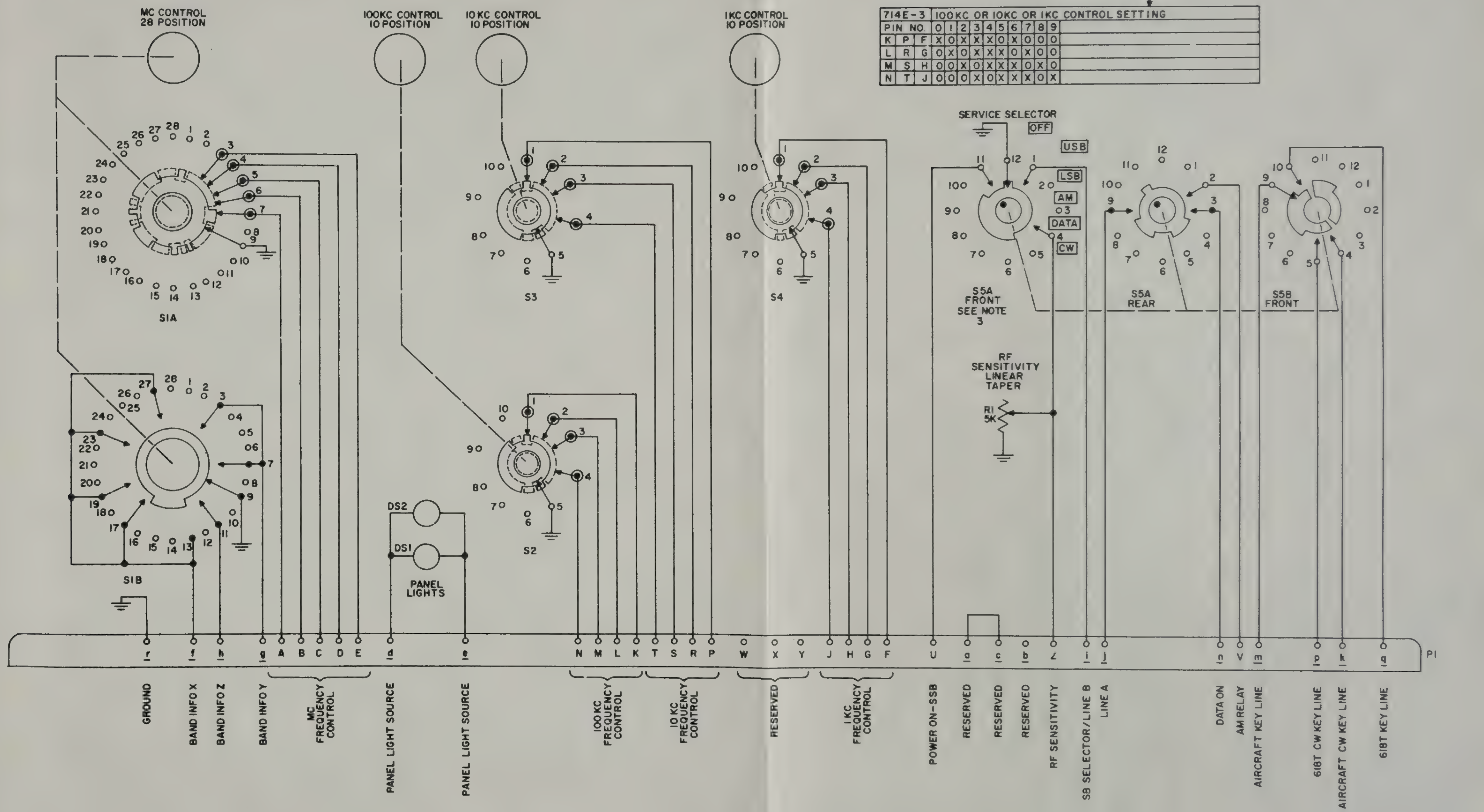
NOTES:

1. KEY TO SWITCHES, (ALL SWITCHES VIEWED FROM FRONT IN OFF OR LOWEST FREQUENCY SETTING.)
   INDICATES FRONT CONTACT.
   INDICATES REAR CONTACT.
   INDICATES FRONT AND REAR CONTACTS CONNECTED.
2. "X" INDICATES GROUND.
   "O" INDICATES WIRES CONNECTED TOGETHER AND NOT GROUNDED.
3. FRONT AND REAR ROTORS ON THE "A" WAFER OF S5 ARE ELECTRICALLY CONNECTED BY A SOLDERED TAB.

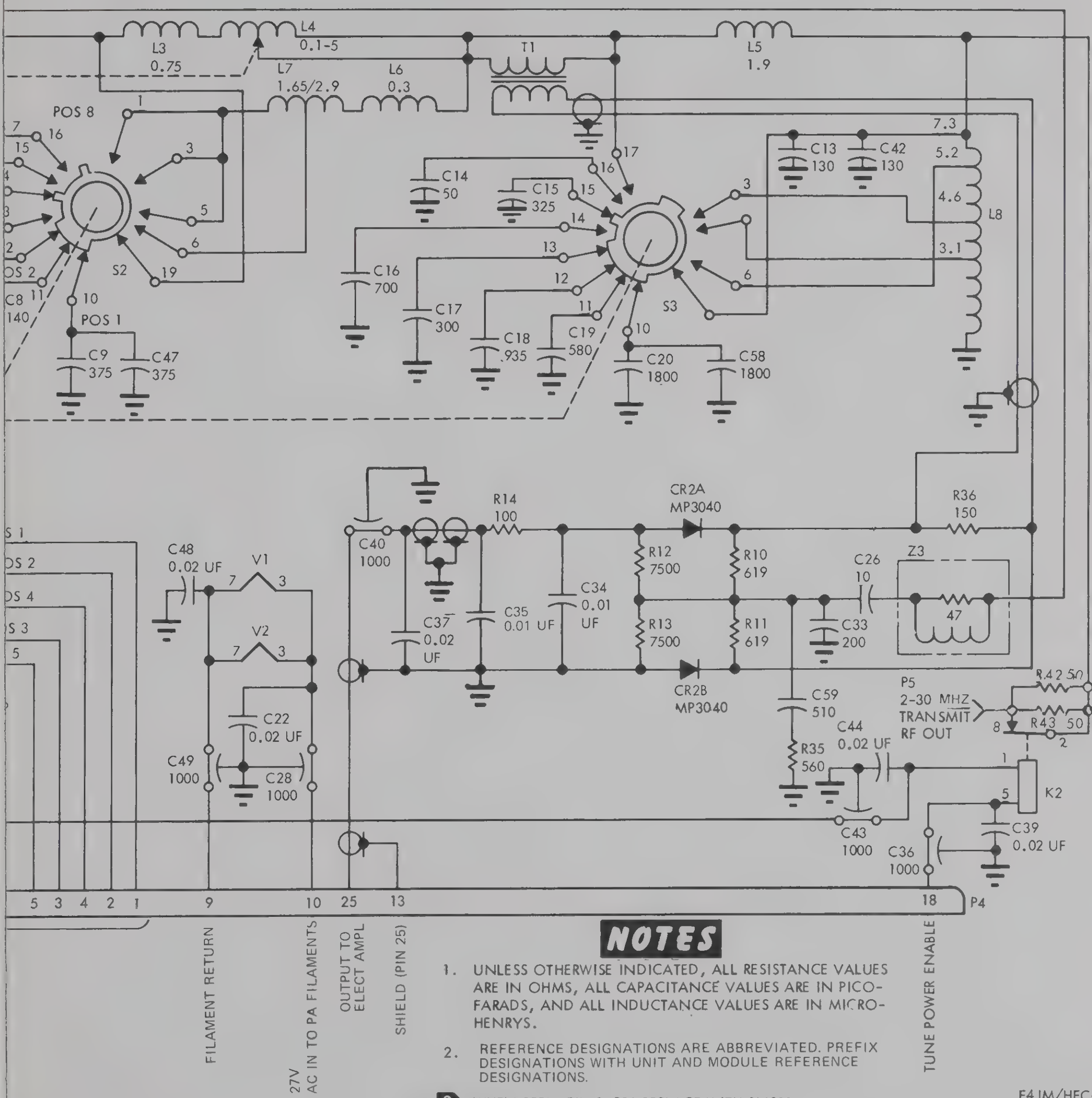
714E-3	MEGACYCLE CONTROL SETTING																										
PIN NO.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
A	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O	O	O	O
B	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O	O	O
C	O	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O	O
D	O	O	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O
E	O	O	O	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O

SEE NOTE 2

714E-3			100KC OR 10KC OR 1KC CONTROL SETTING									
PIN NO.			0	1	2	3	4	5	6	7	8	9
K	P	F	X	O	X	X	X	O	X	O	O	O
L	R	G	O	X	O	X	X	X	O	X	O	O
M	S	H	O	O	X	O	X	X	X	O	X	O
N	T	J	O	O	O	X	O	X	X	X	O	X



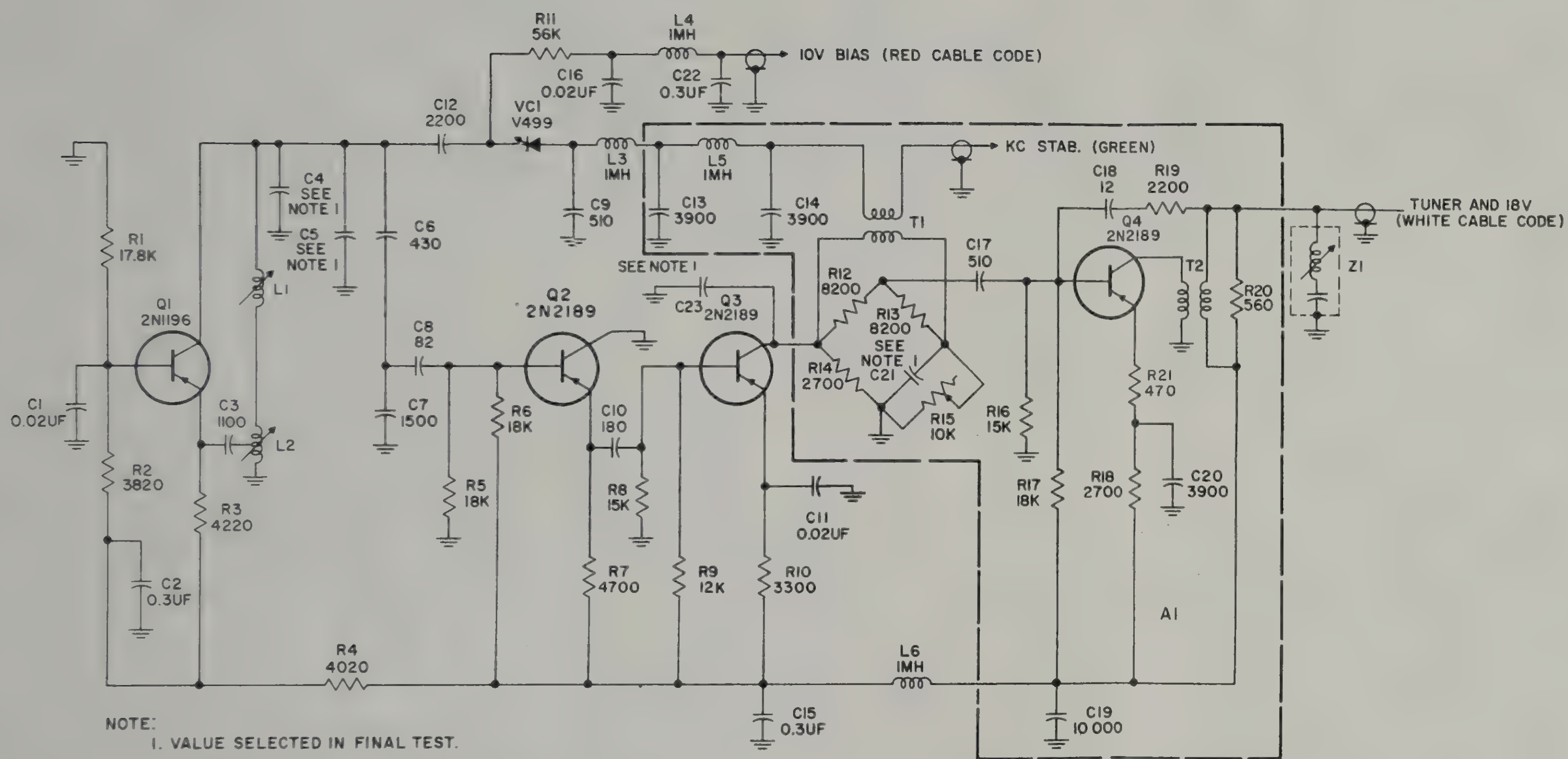
Control Unit 714E-3, Schematic Diagram
Figure 1107



NOTES

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN PICO-FARADS, AND ALL INDUCTANCE VALUES ARE IN MICRO-HENRYS.
2. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX DESIGNATIONS WITH UNIT AND MODULE REFERENCE DESIGNATIONS.
3. WHEN REPLACING CR3 REPLACE WITH 1N933.

Figure 8-59. Power Amplifier 2A11, Schematic Diagram



VFO Submodule, Model 70K-5, Schematic Diagram
Figure 1108

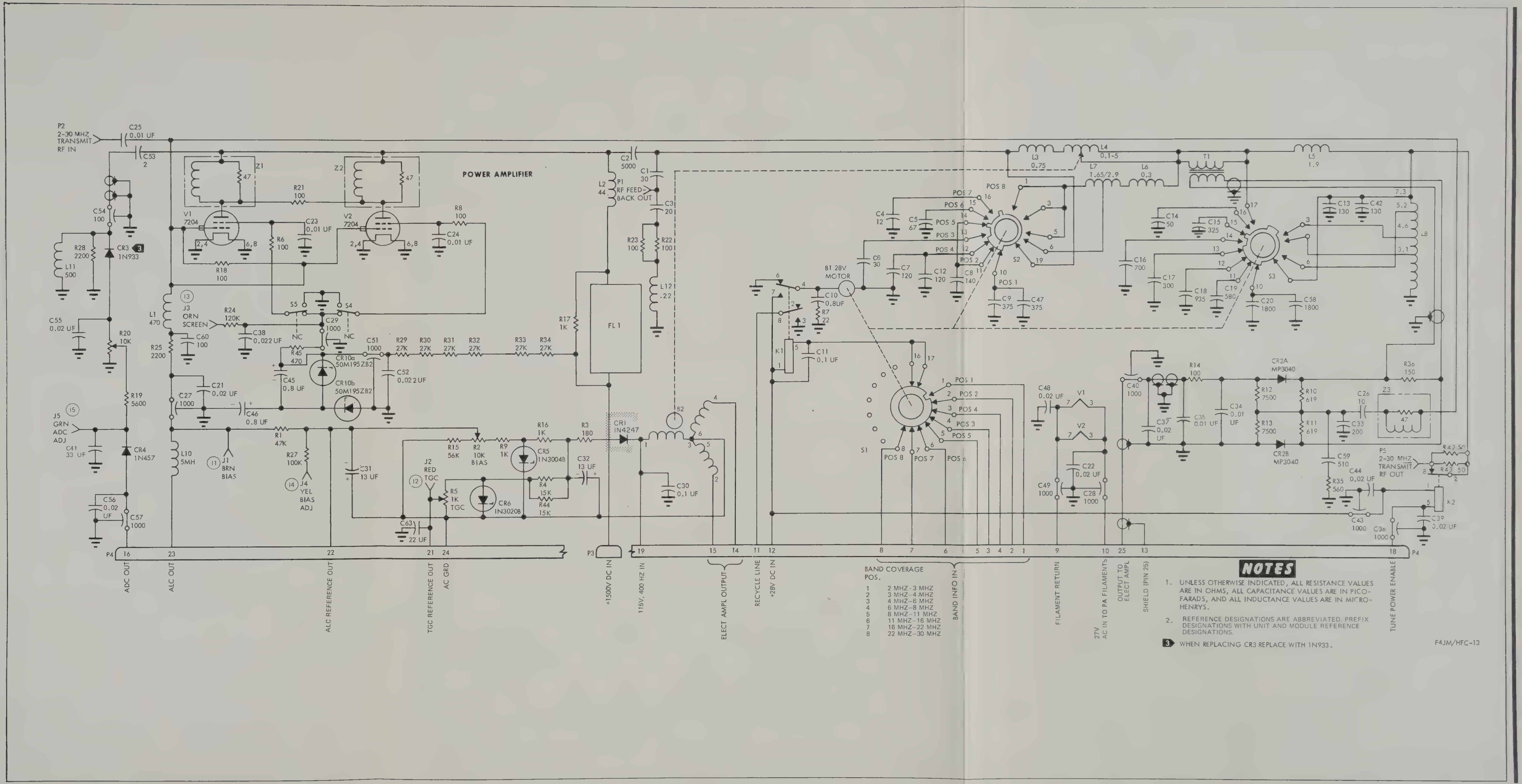
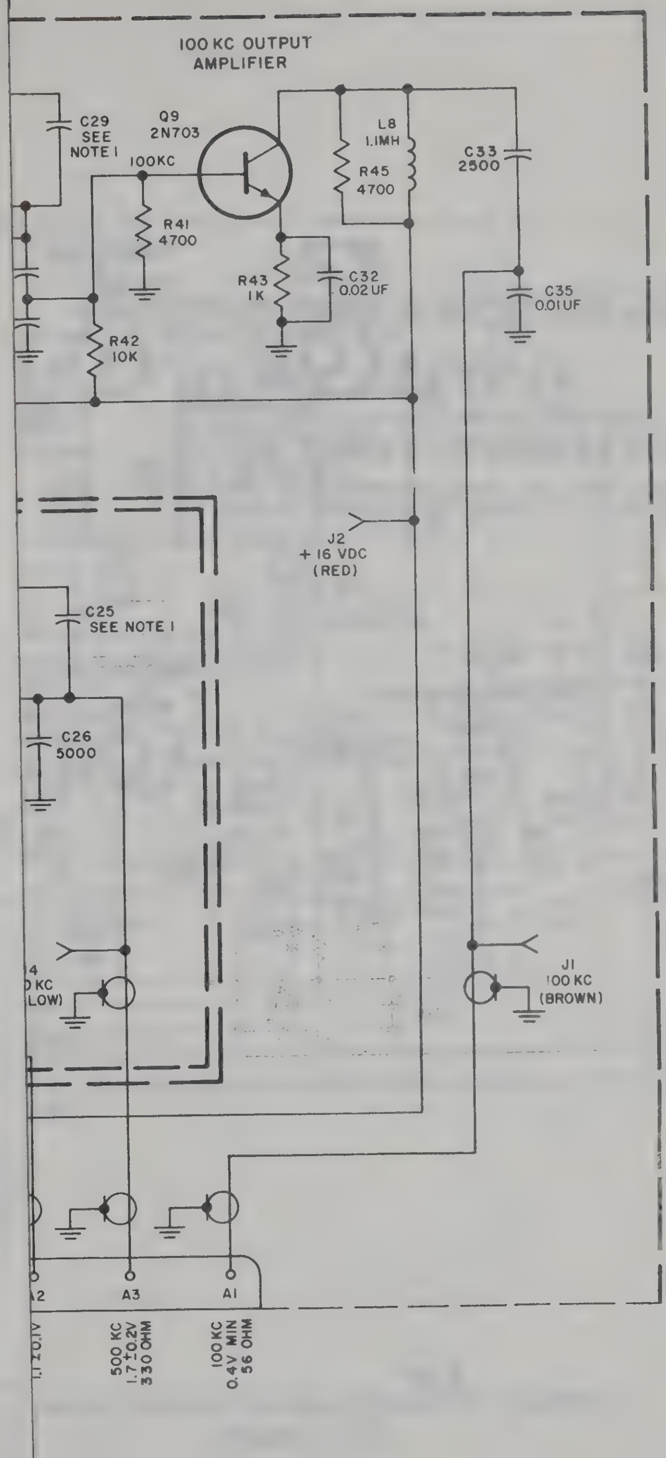
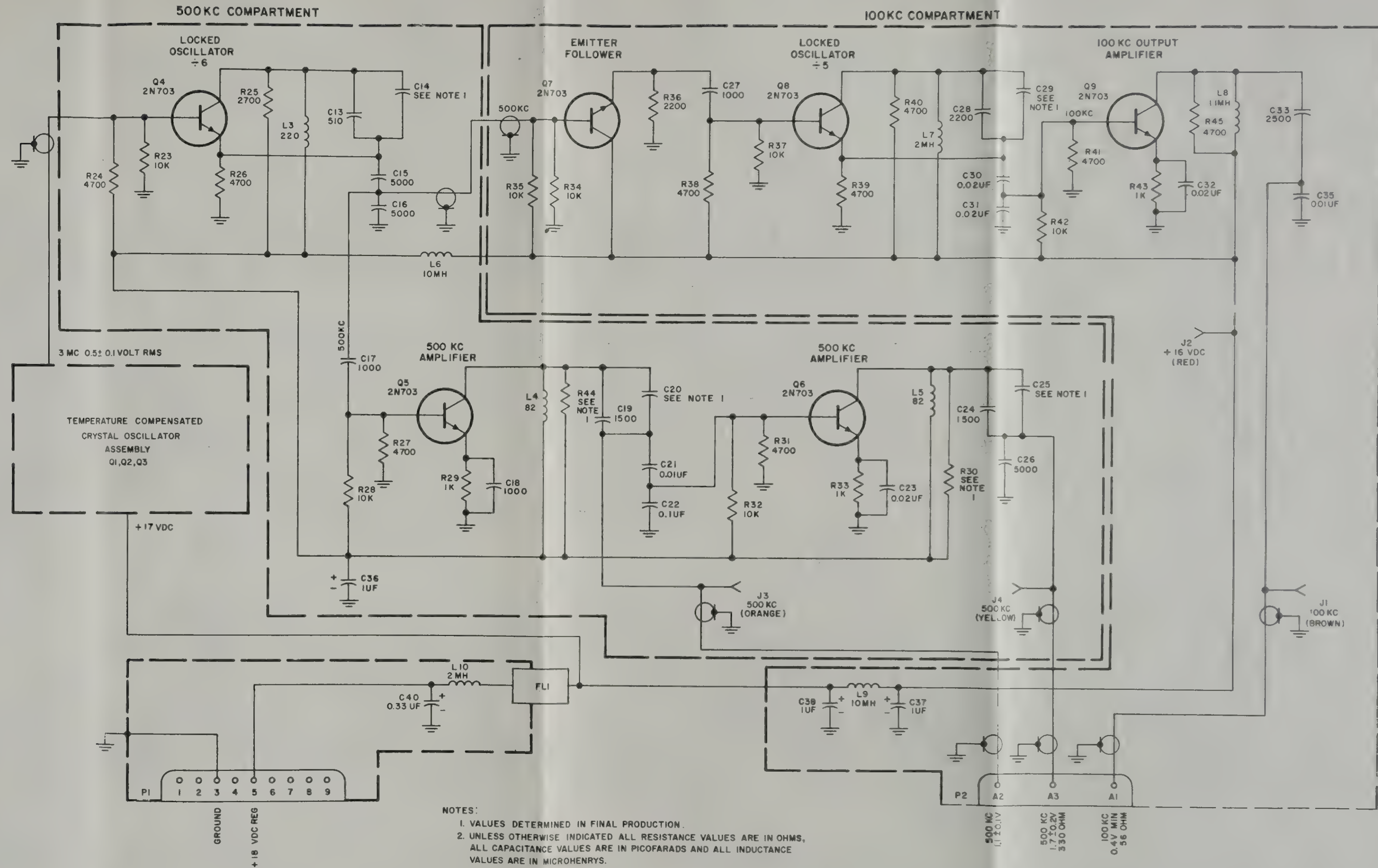


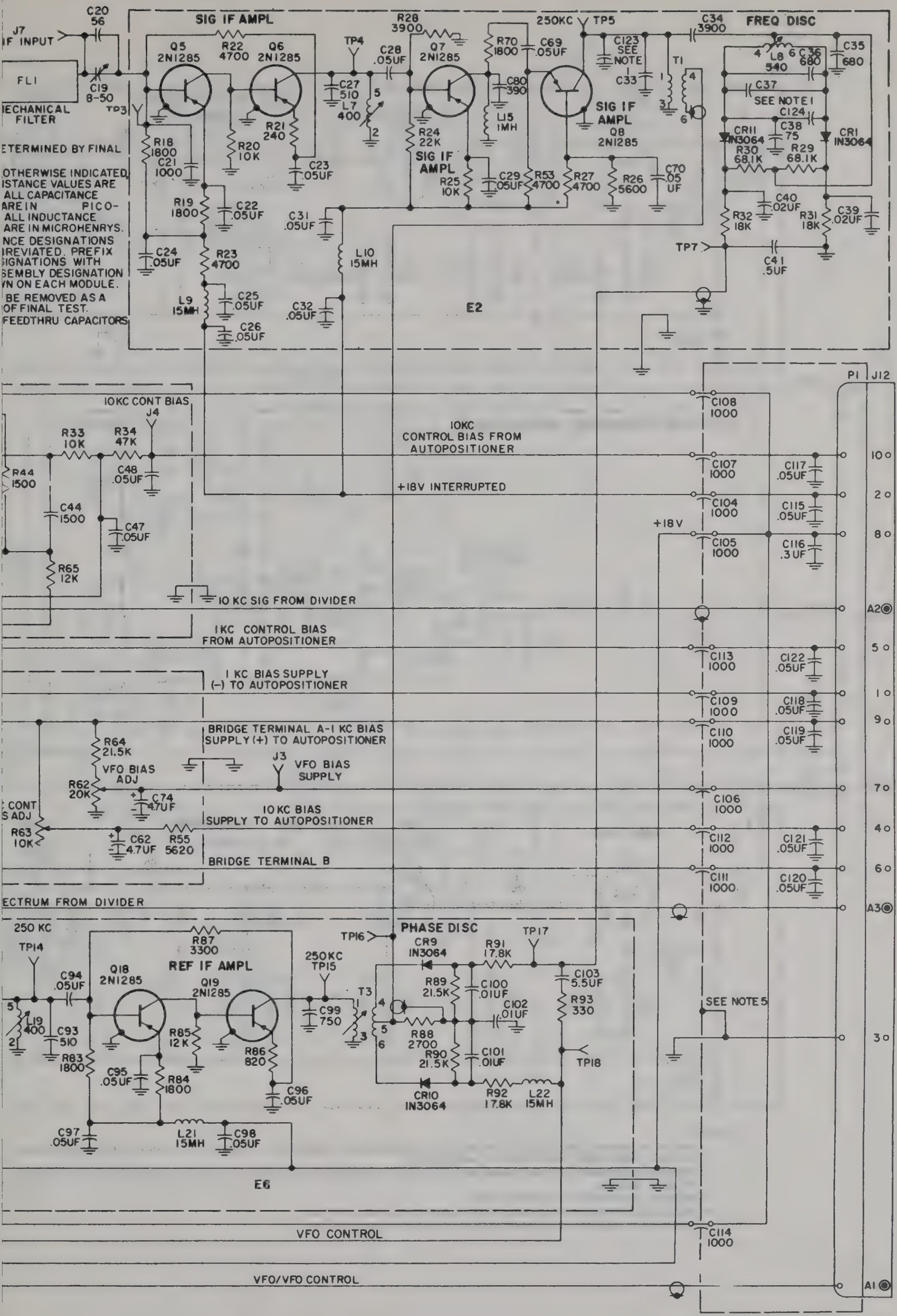
Figure 8-59. Power Amplifier 2A11, Schematic Diagram



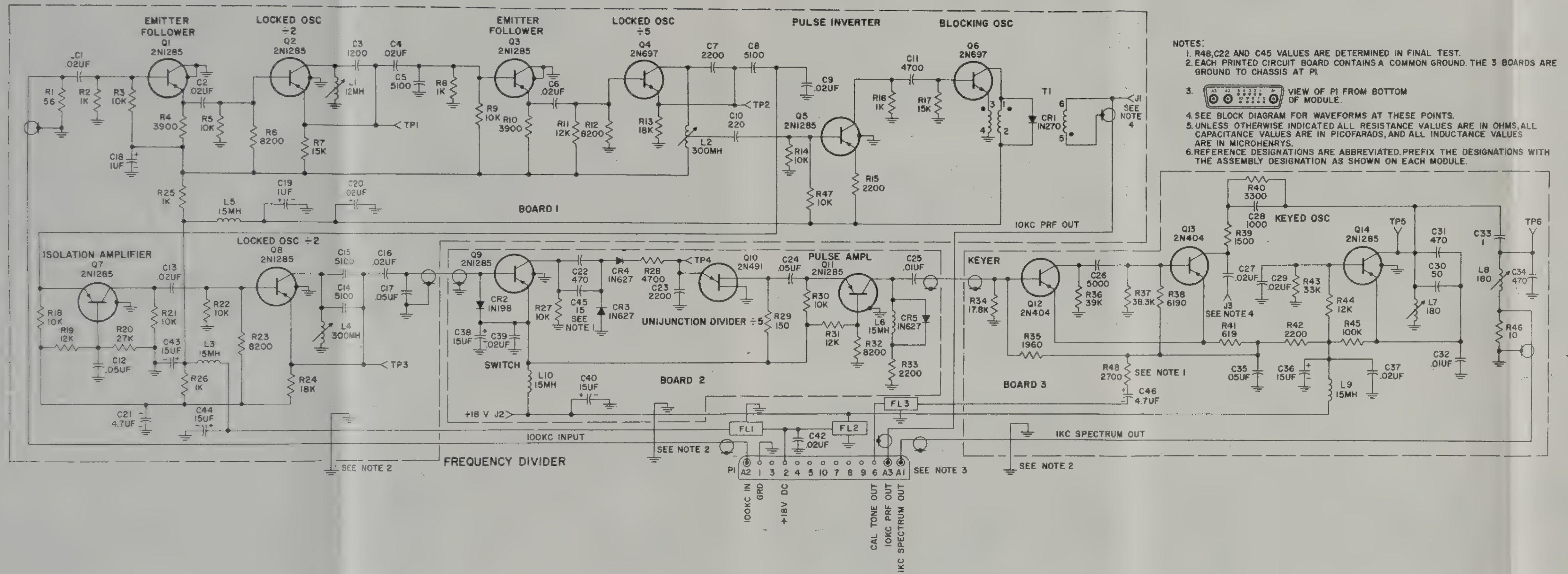
R-F Oscillator Module, Schematic Diagram
Figure 1111



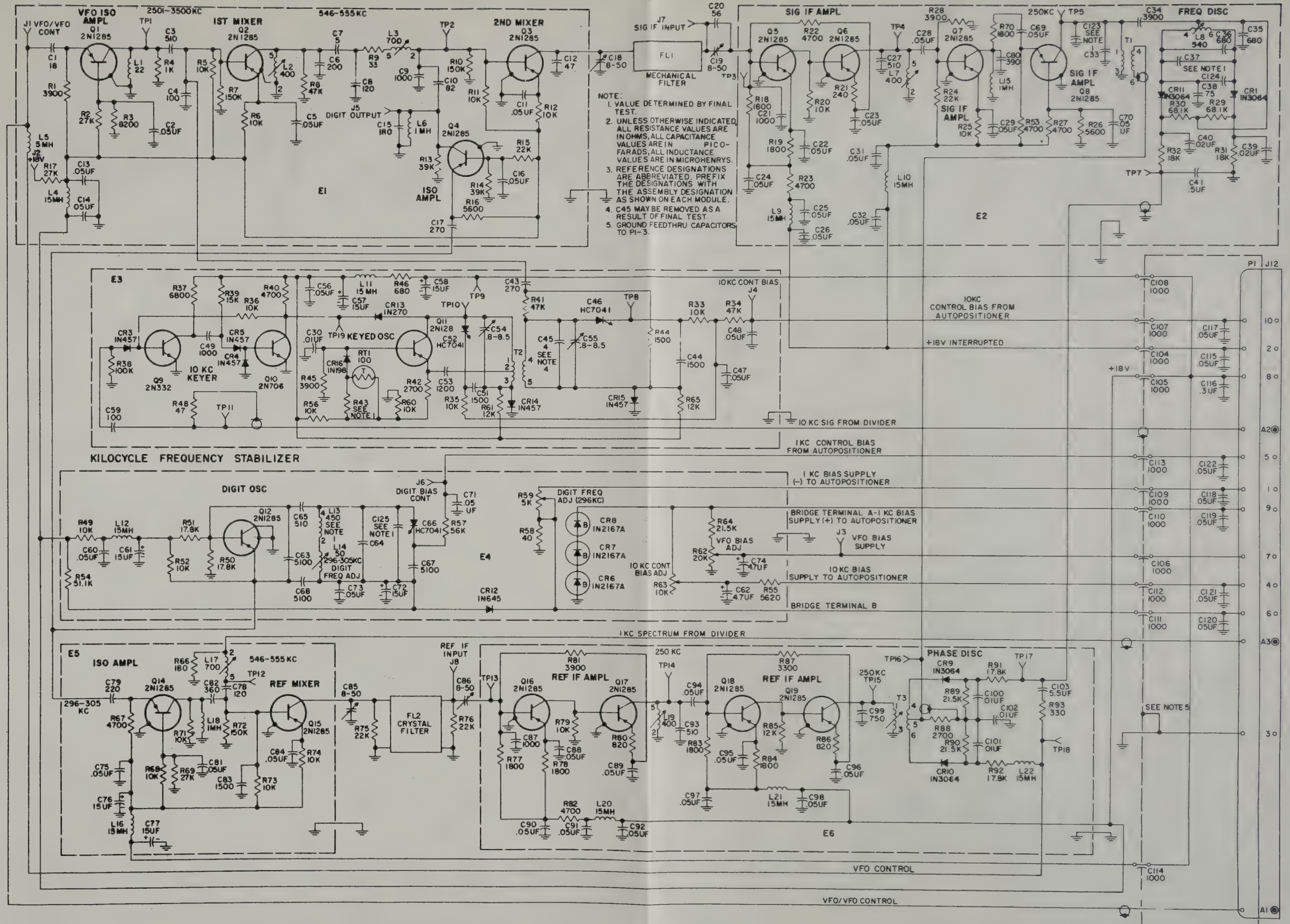
R-F Oscillator Module, Schematic Diagram
Figure 1111



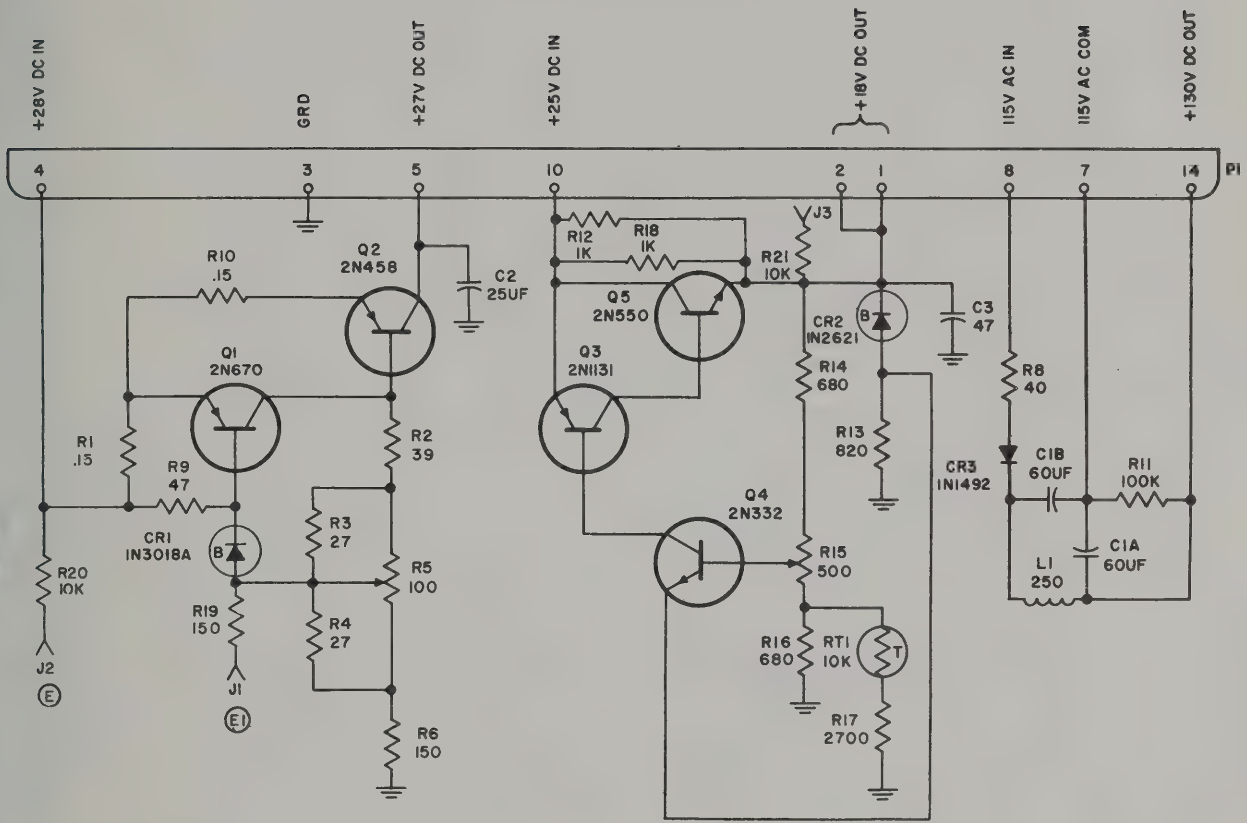
Kilocycle-Frequency Stabilizer Module, Schematic Diagram
Figure 1113



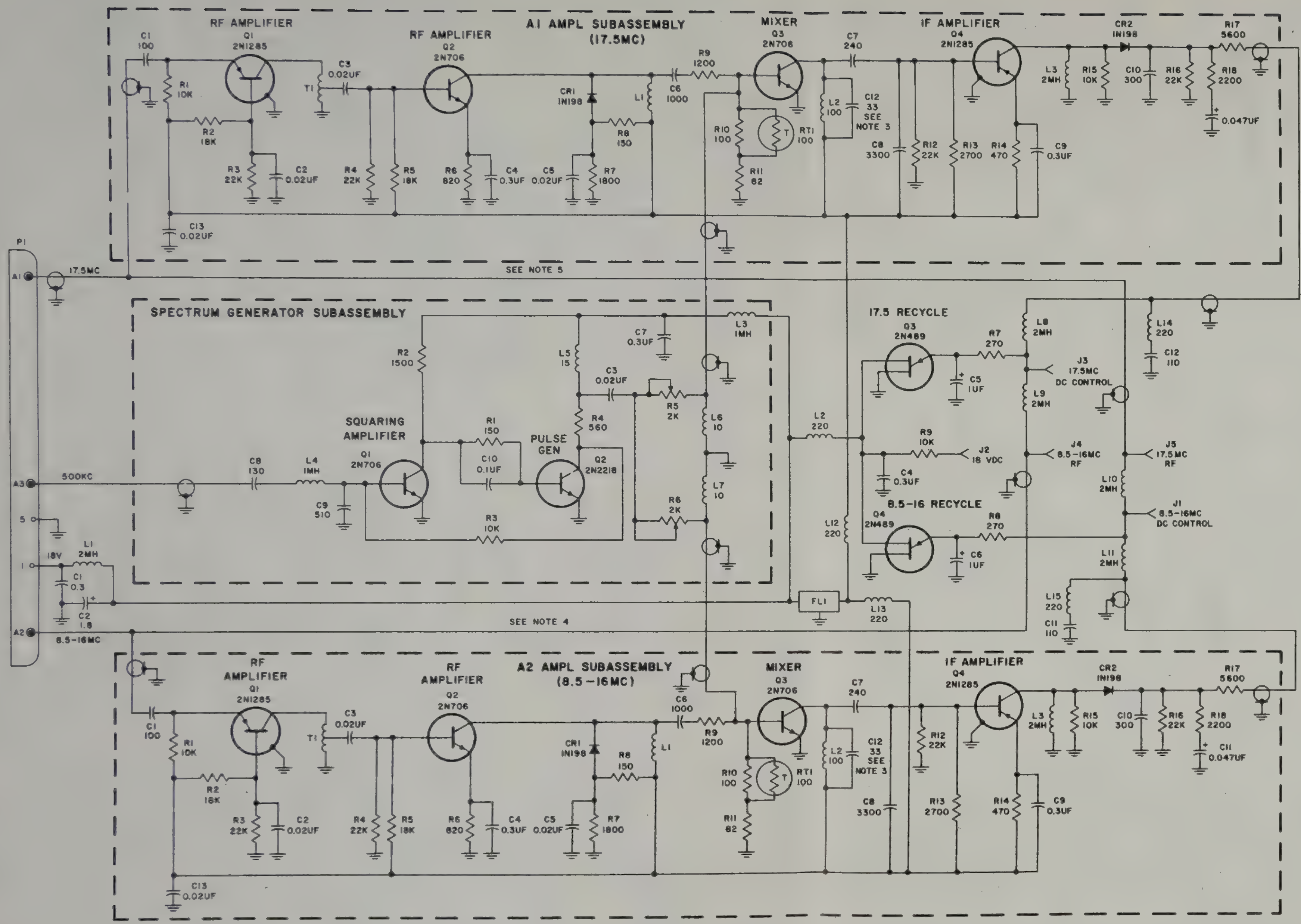
Frequency Divider Module, Schematic Diagram
Figure 1112



Kilocycle-Frequency Stabilizer Module,
Schematic Diagram
Figure 1113

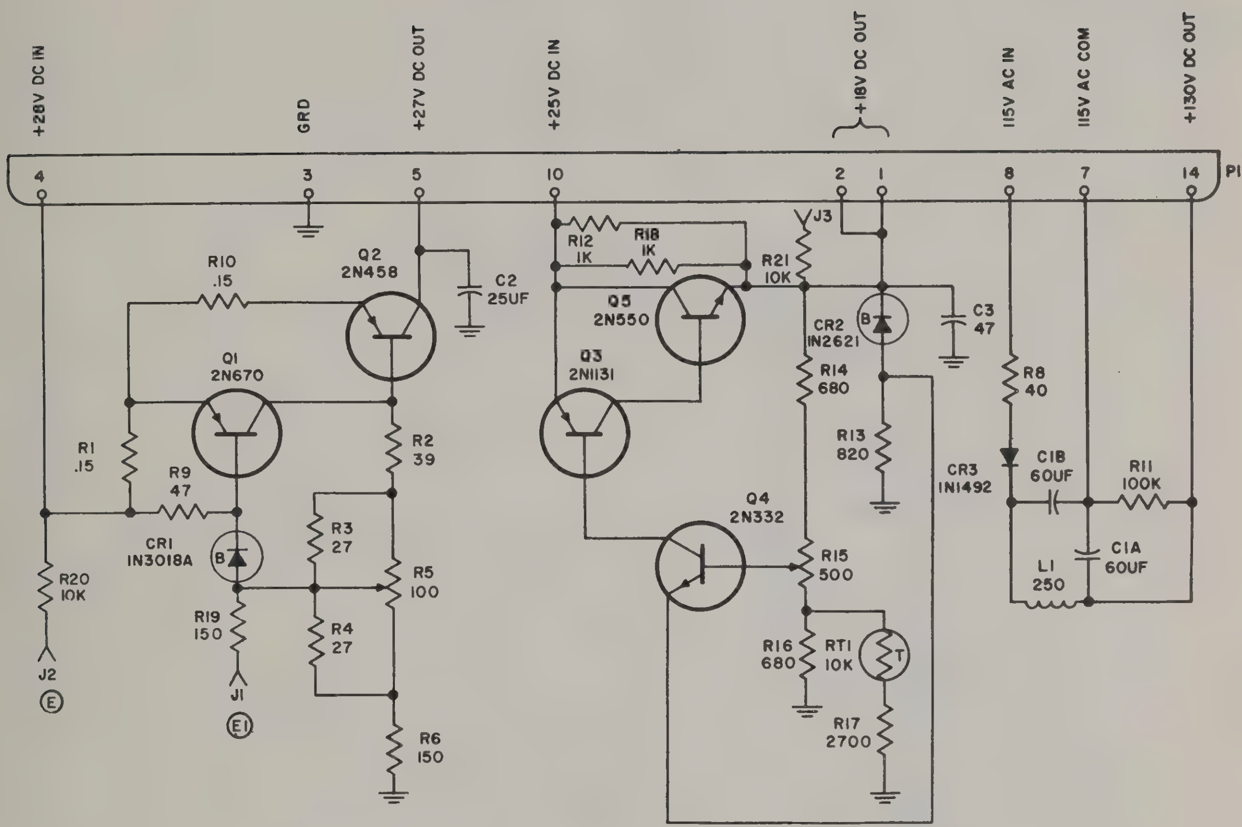


Low-Voltage Power Supply Module, Schematic Diagram
Figure 1115

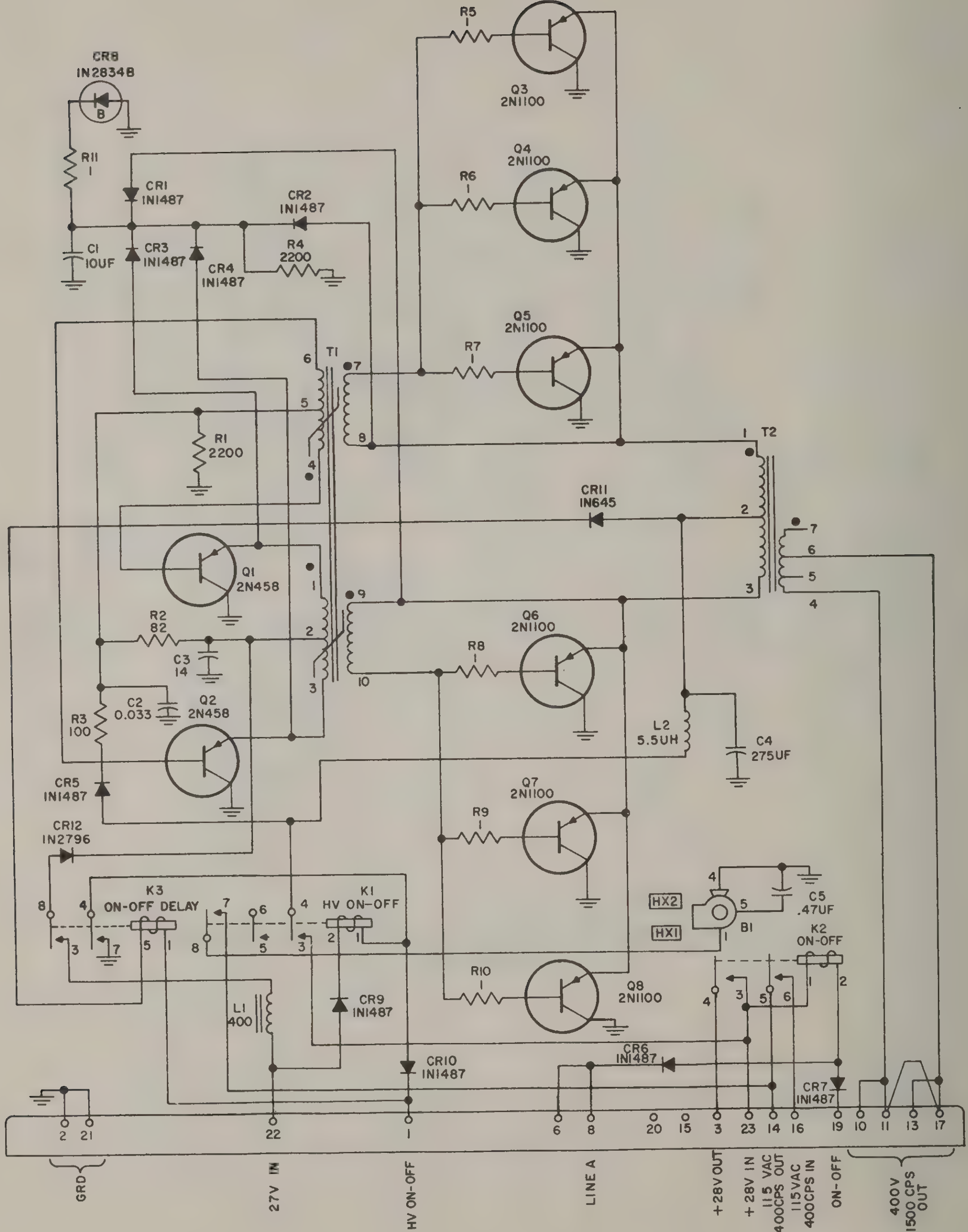


NOTES:
1. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN PICOFARADS, AND ALL INDUCTANCE VALUES ARE IN MICROHENRYS.
2. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH THE ASSEMBLY DESIGNATION AS SHOWN ON EACH MODULE.
3. NOMINAL VALUE SELECTED DURING TEST.
4. 17.5MC DC CONTROL IS RETURNED TO RF TUNER BY 8.5-16MC RF LINE.
5. 8.5-16MC DC CONTROL IS RETURNED TO RF TUNER BY 17.5MC RF LINE.

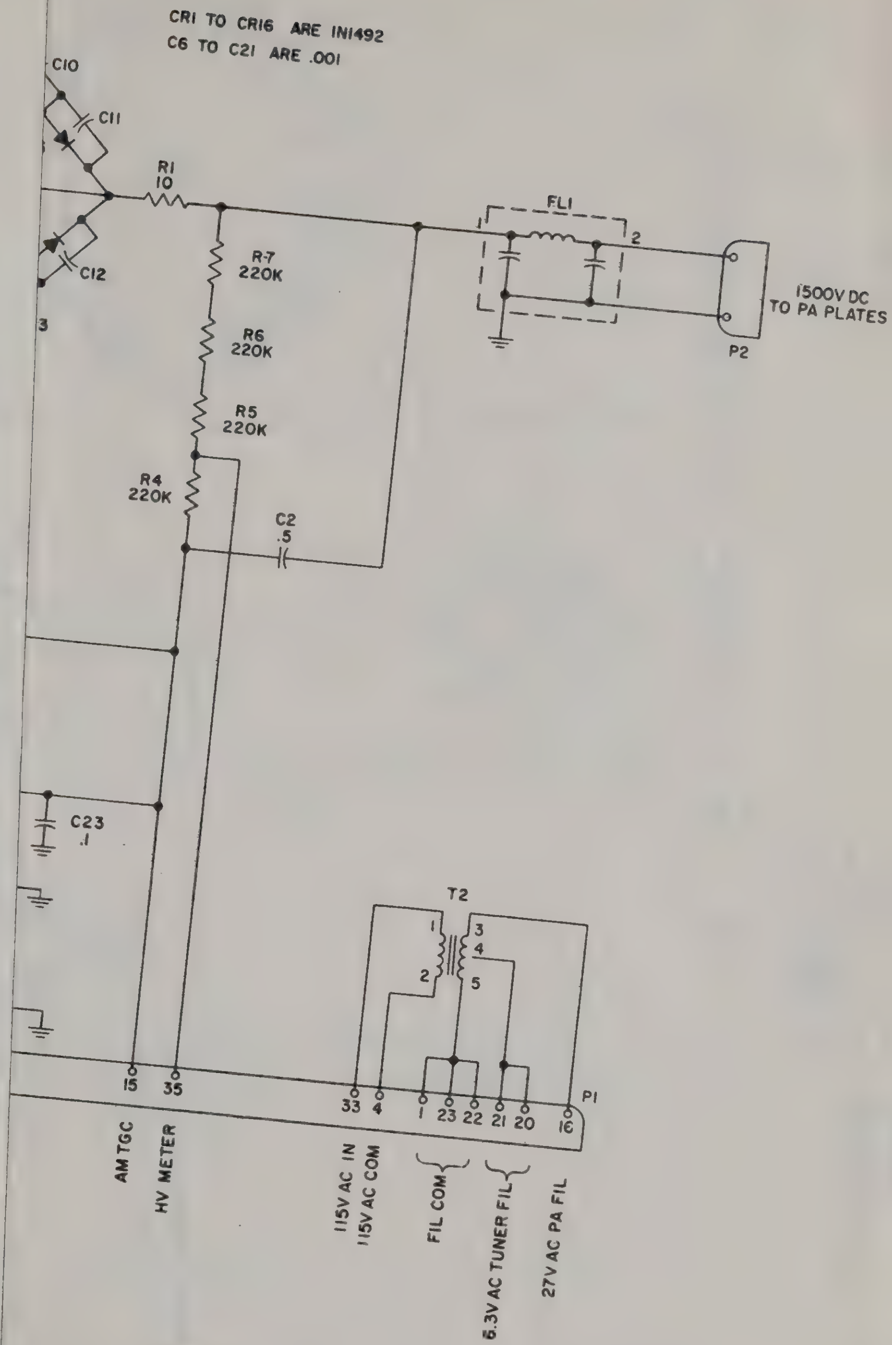
Megacycle-Frequency Stabilizer Module,
Schematic Diagram
Figure 1114



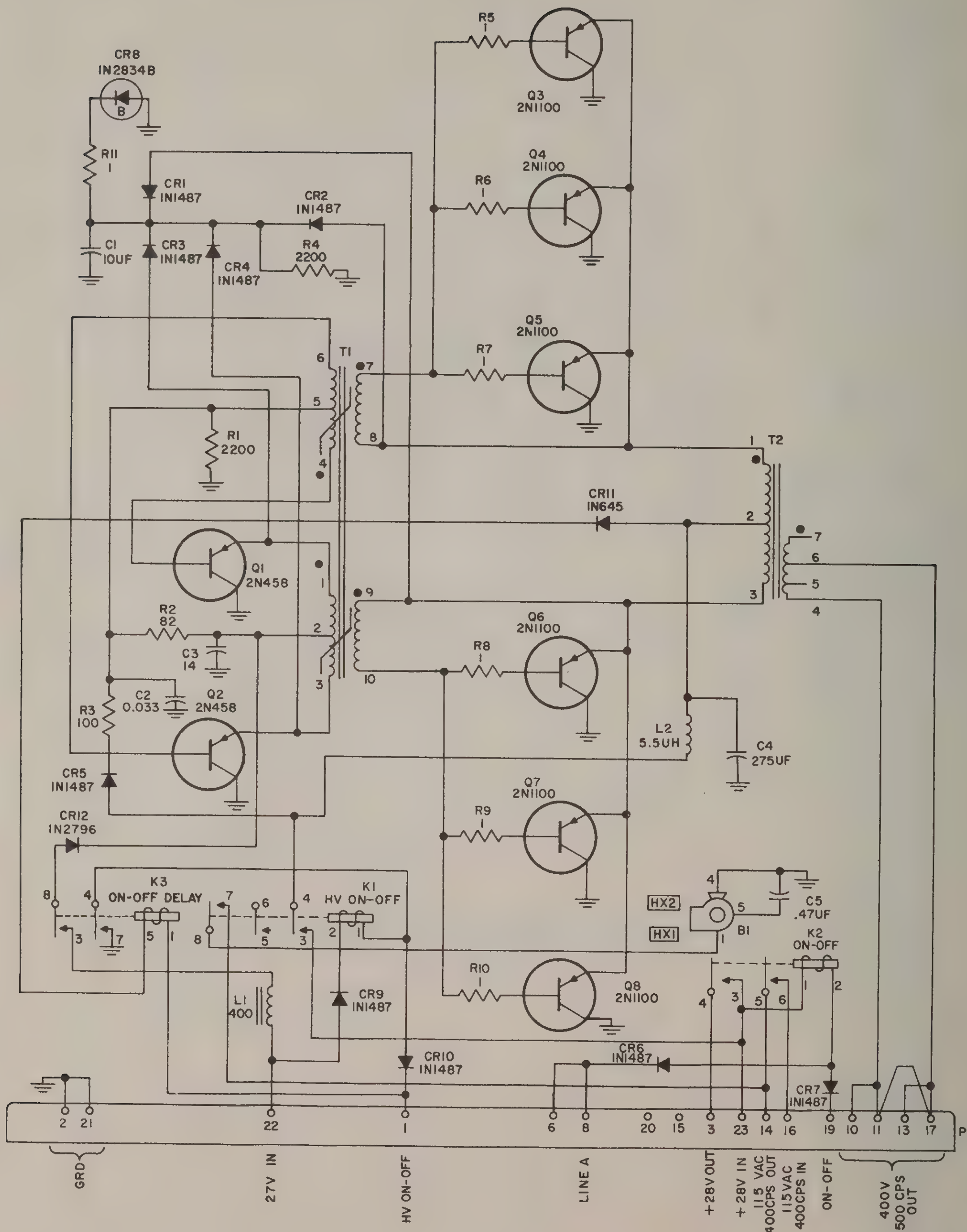
Low-Voltage Power Supply Module, Schematic Diagram
Figure 1115



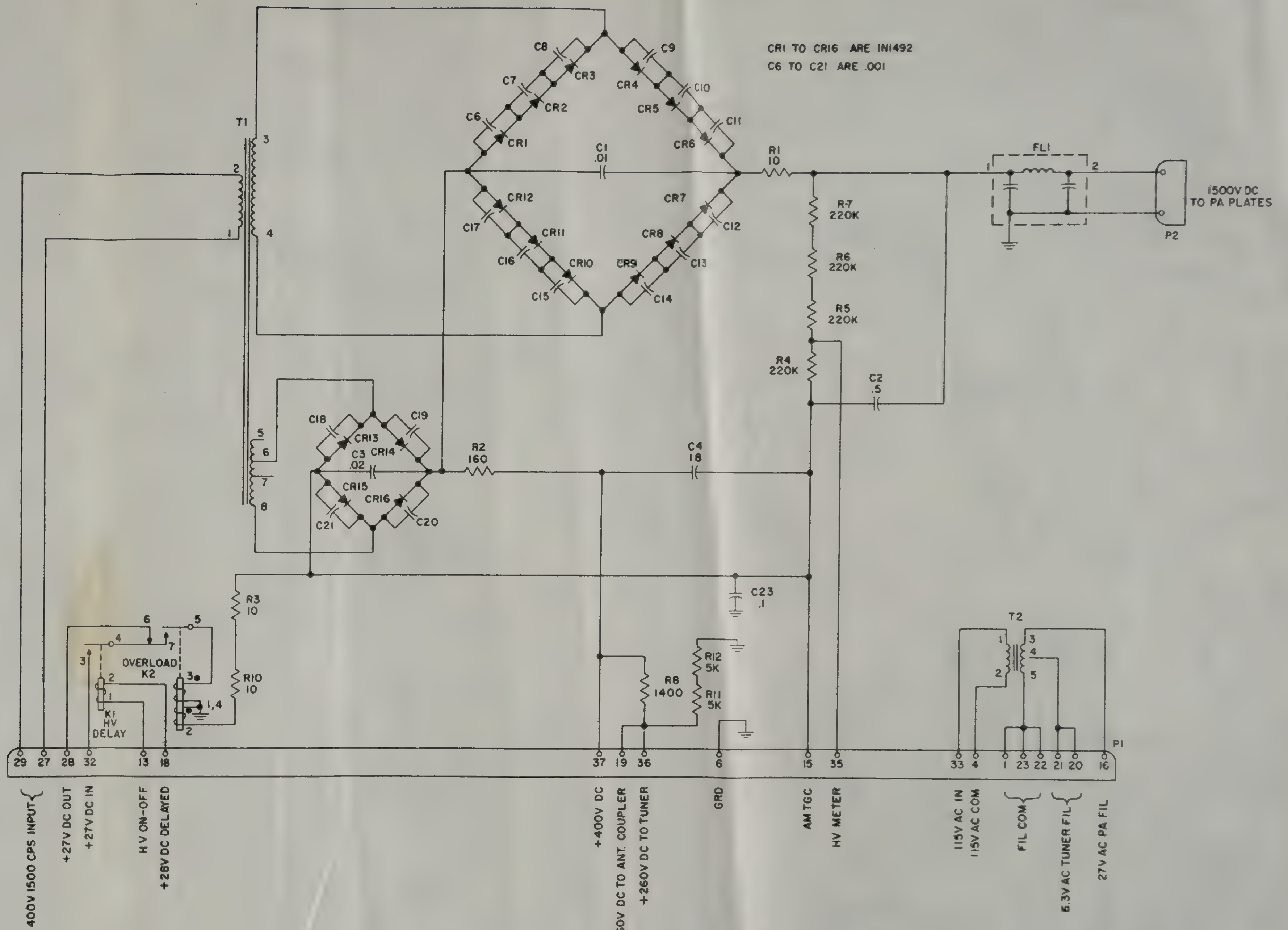
Power Supply 516H-1, Schematic Diagram
Figure 1116



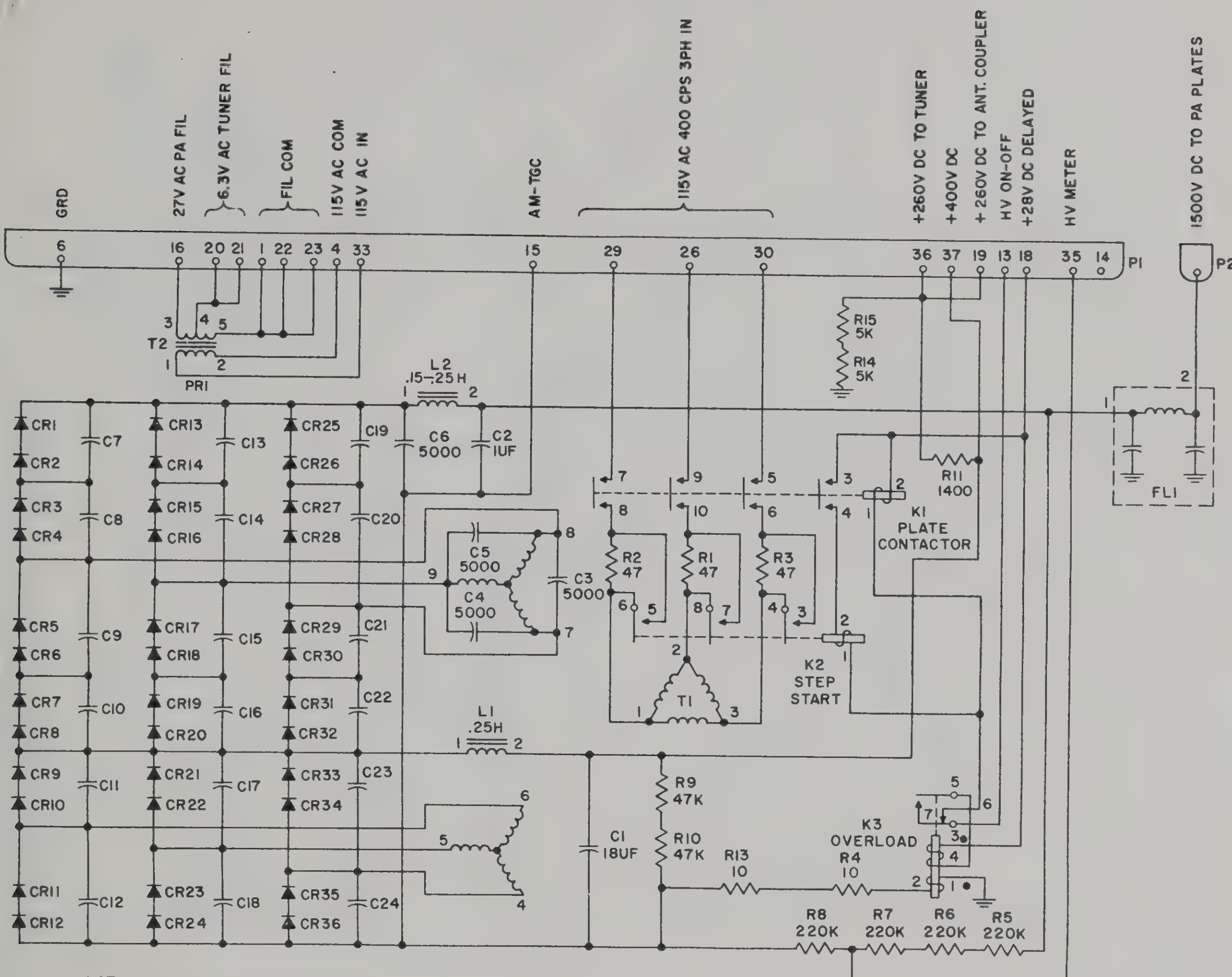
Single-Phase High-Voltage Power Supply Module,
Schematic Diagram
Figure 1117



Power Supply 516H-1, Schematic Diagram
Figure 1116

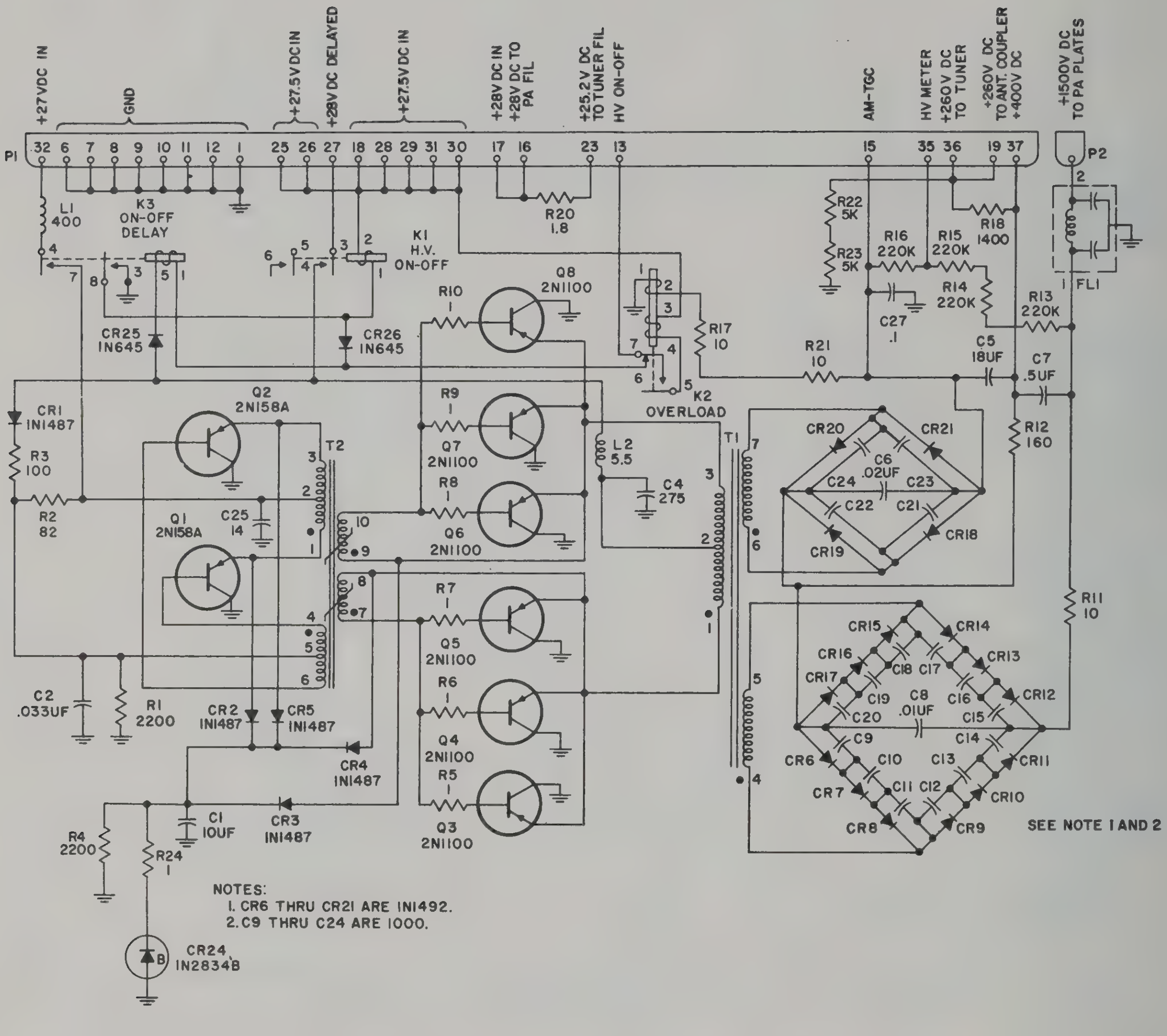


Single-Phase High-Voltage Power Supply Module, Schematic Diagram
Figure 1117

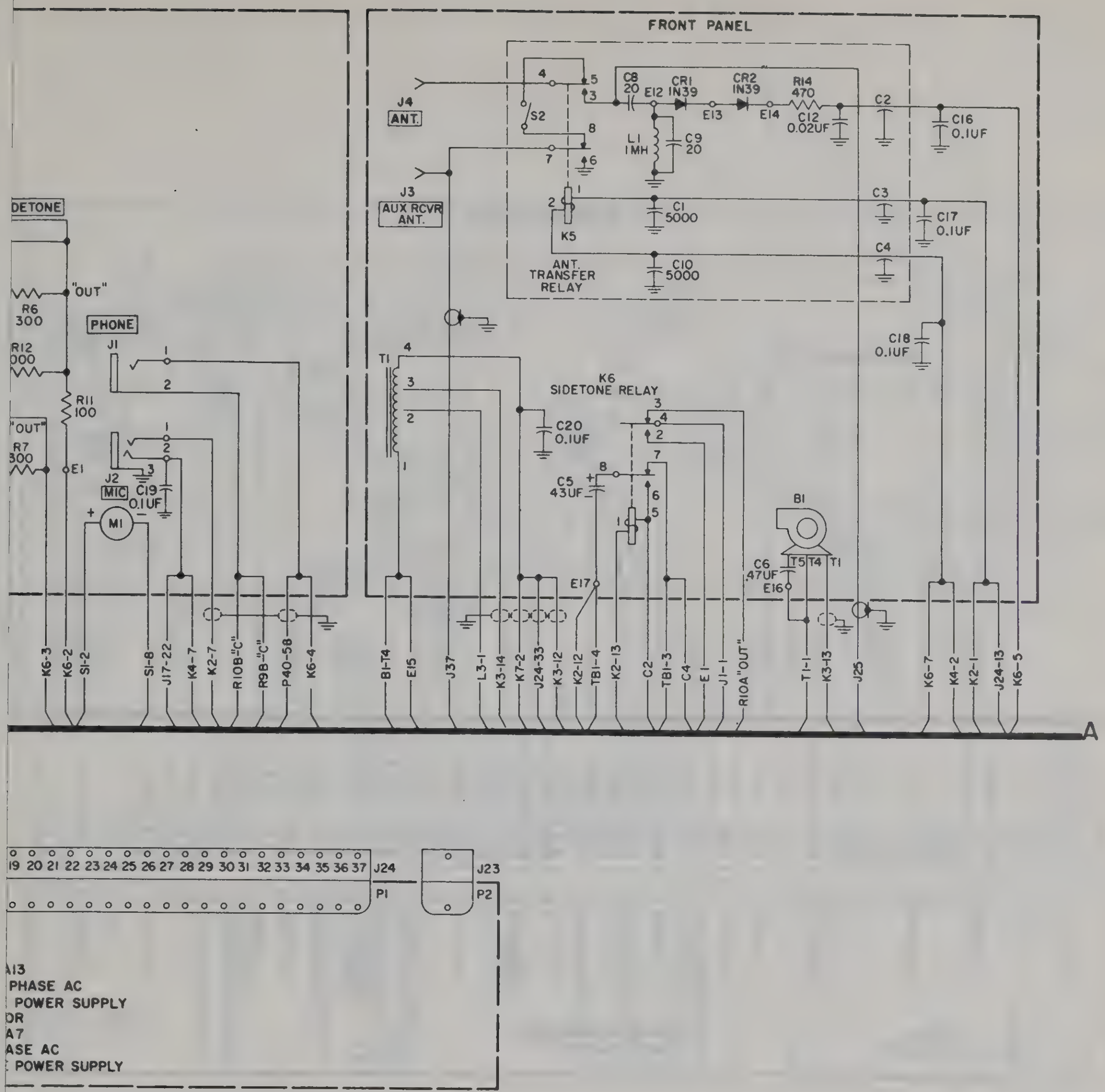


NOTES:
1. CR1 THRU CR36 ARE 1N1492 TYPE.
2. C7 THRU C24 ARE 1000 UUF.

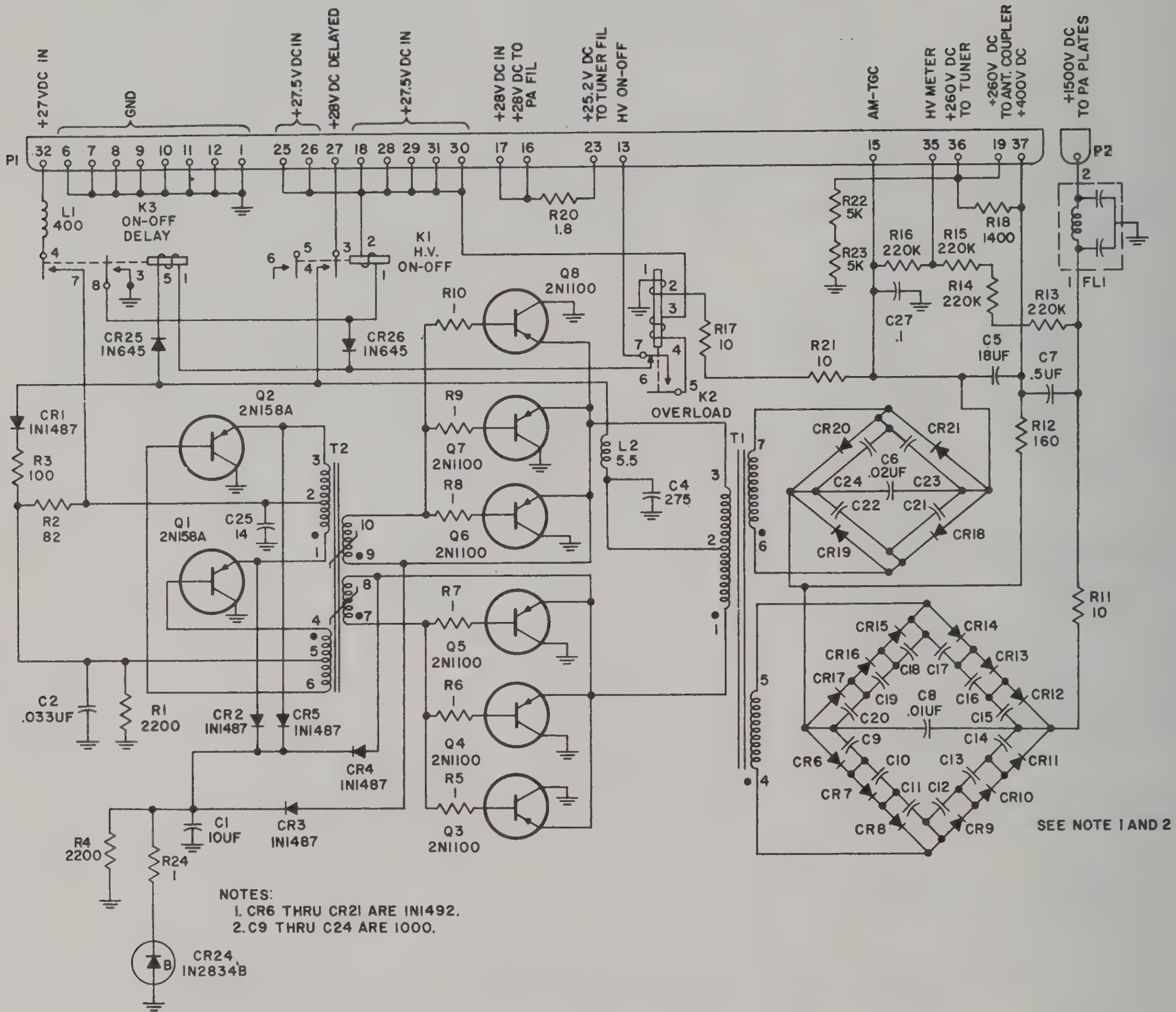
Three-Phase High-Voltage Power Supply Module, Schematic Diagram
Figure 1118



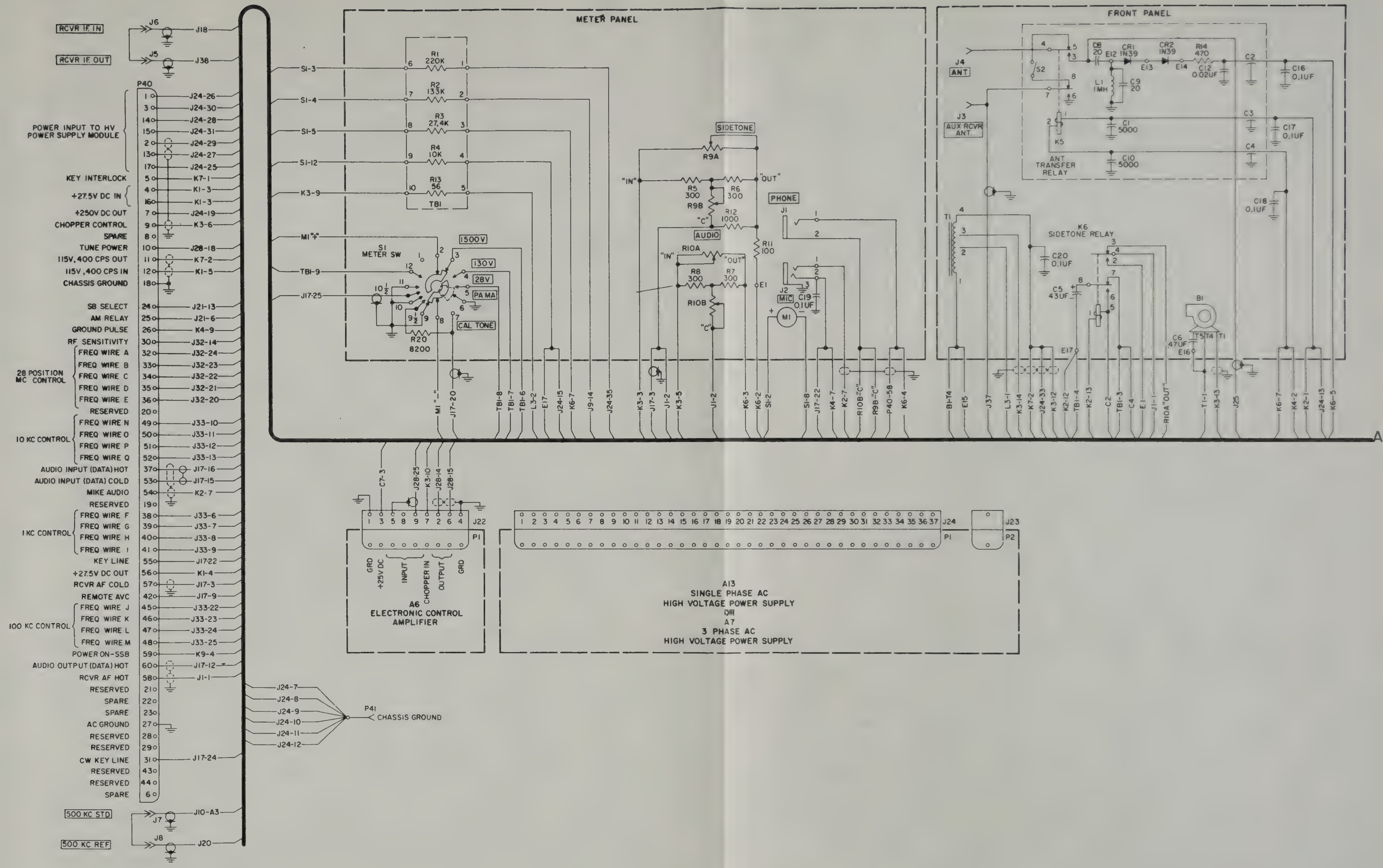
27.5-Volt D-C High-Voltage Power Supply Module, Schematic Diagram
Figure 1119



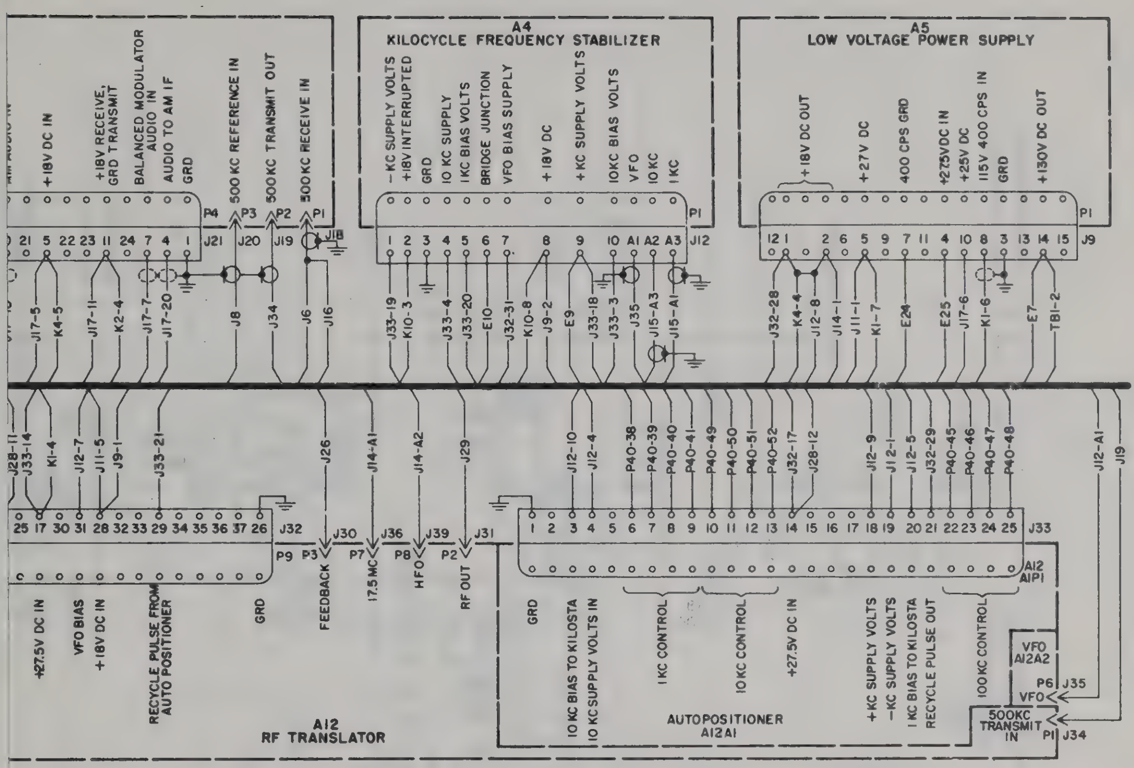
Airborne SSB Transceiver 618T-1( ),
Chassis Wiring Diagram (Sheet 1 of 3)
Figure 1120



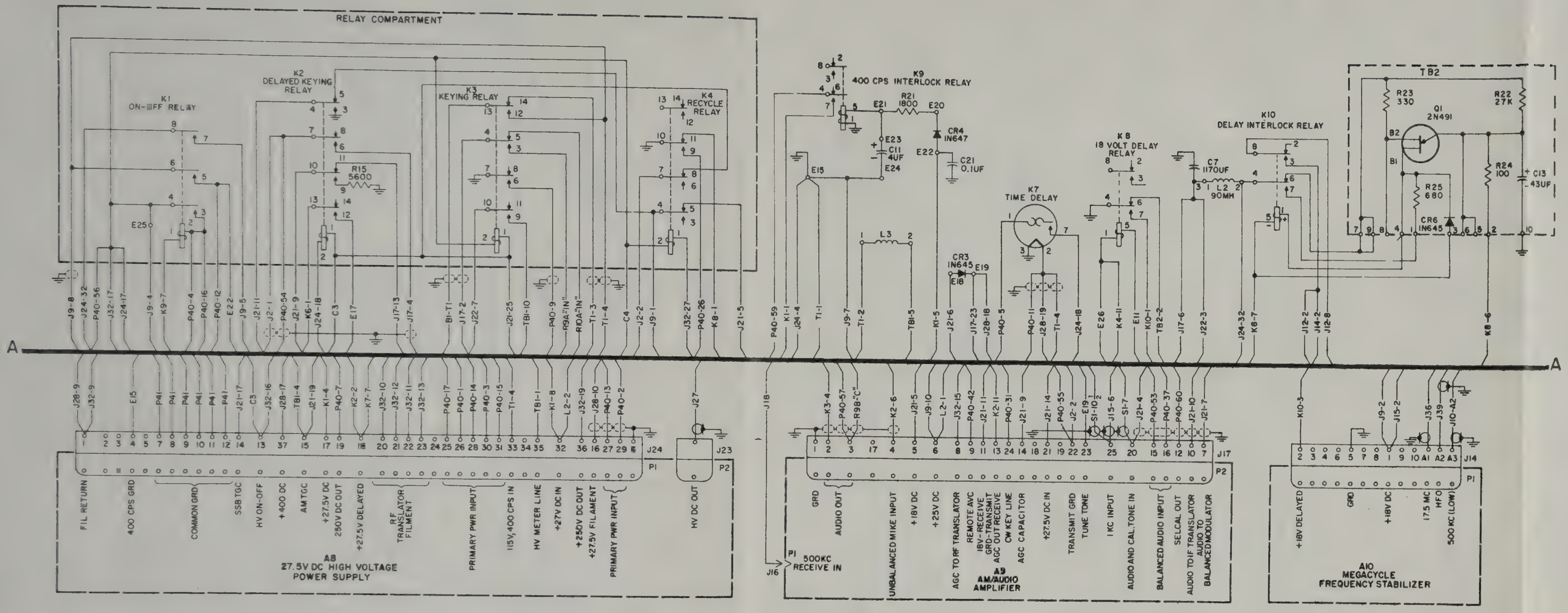
27.5-Volt D-C High-Voltage Power Supply Module, Schematic Diagram
Figure 1119



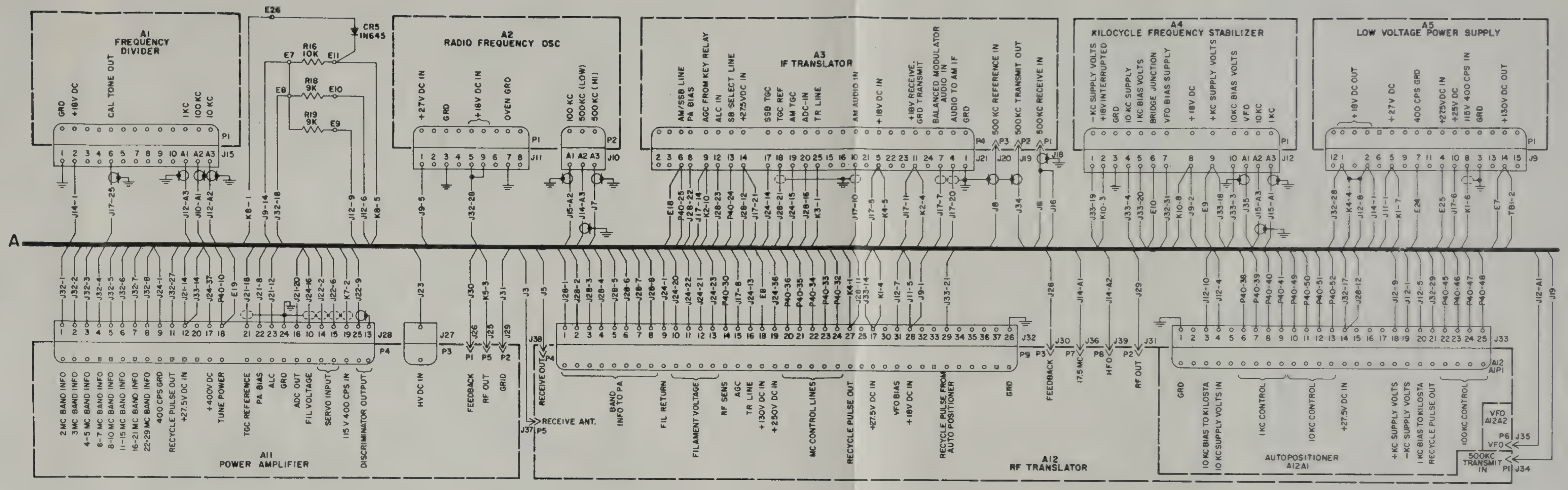
Airborne SSB Transceiver 618T-1( ),
Chassis Wiring Diagram (Sheet 1 of 3)
Figure 1120



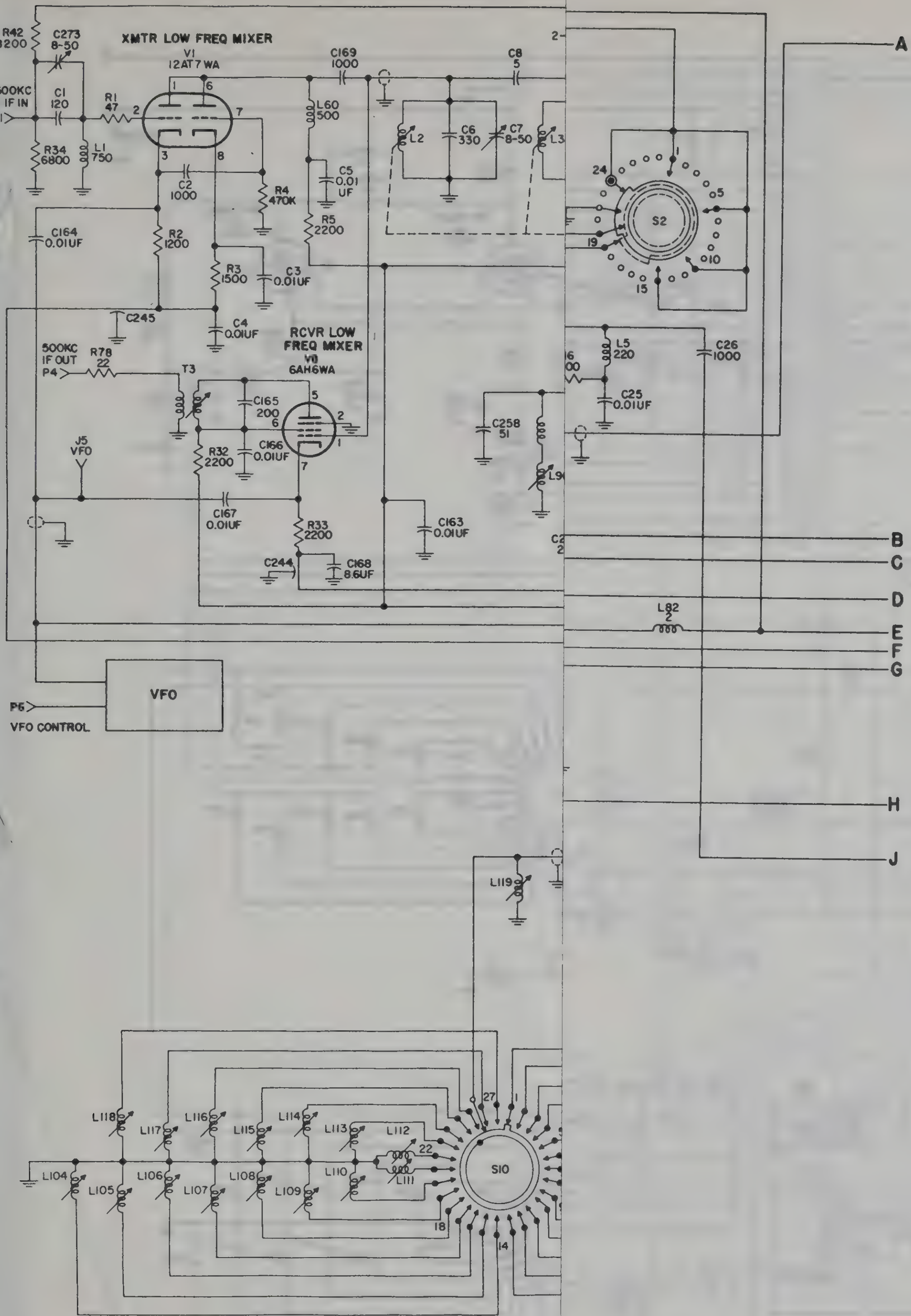
Airborne SSB Transceiver 618T-1( ),
Chassis Wiring Diagram (Sheet 3 of 3)
Figure 1120



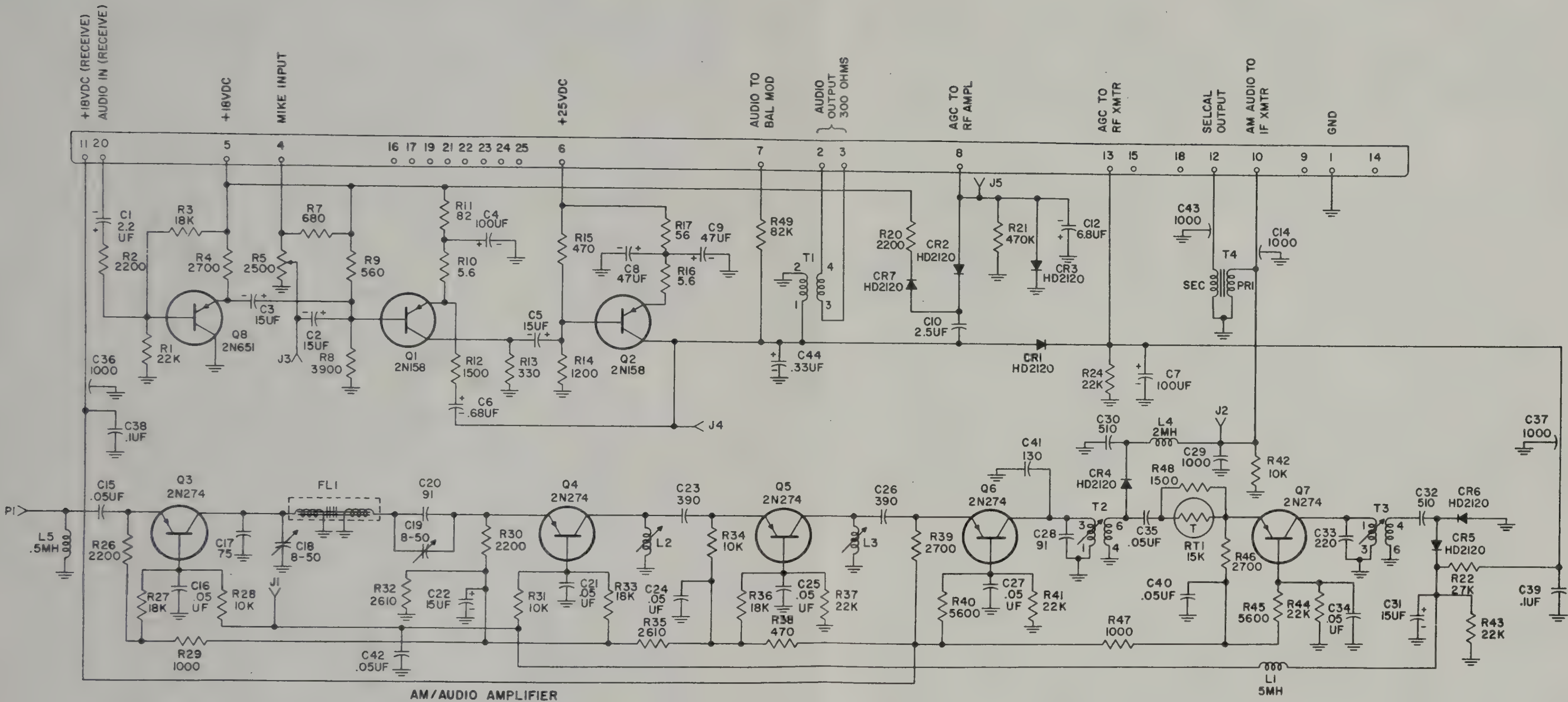
Airborne SSB Transceiver 618T-1( ),
Chassis Wiring Diagram (Sheet 2 of 3)
Figure 1120



Airborne SSB Transceiver 618T-1( ),
Chassis Wiring Diagram (Sheet 3 of 3)
Figure 1120



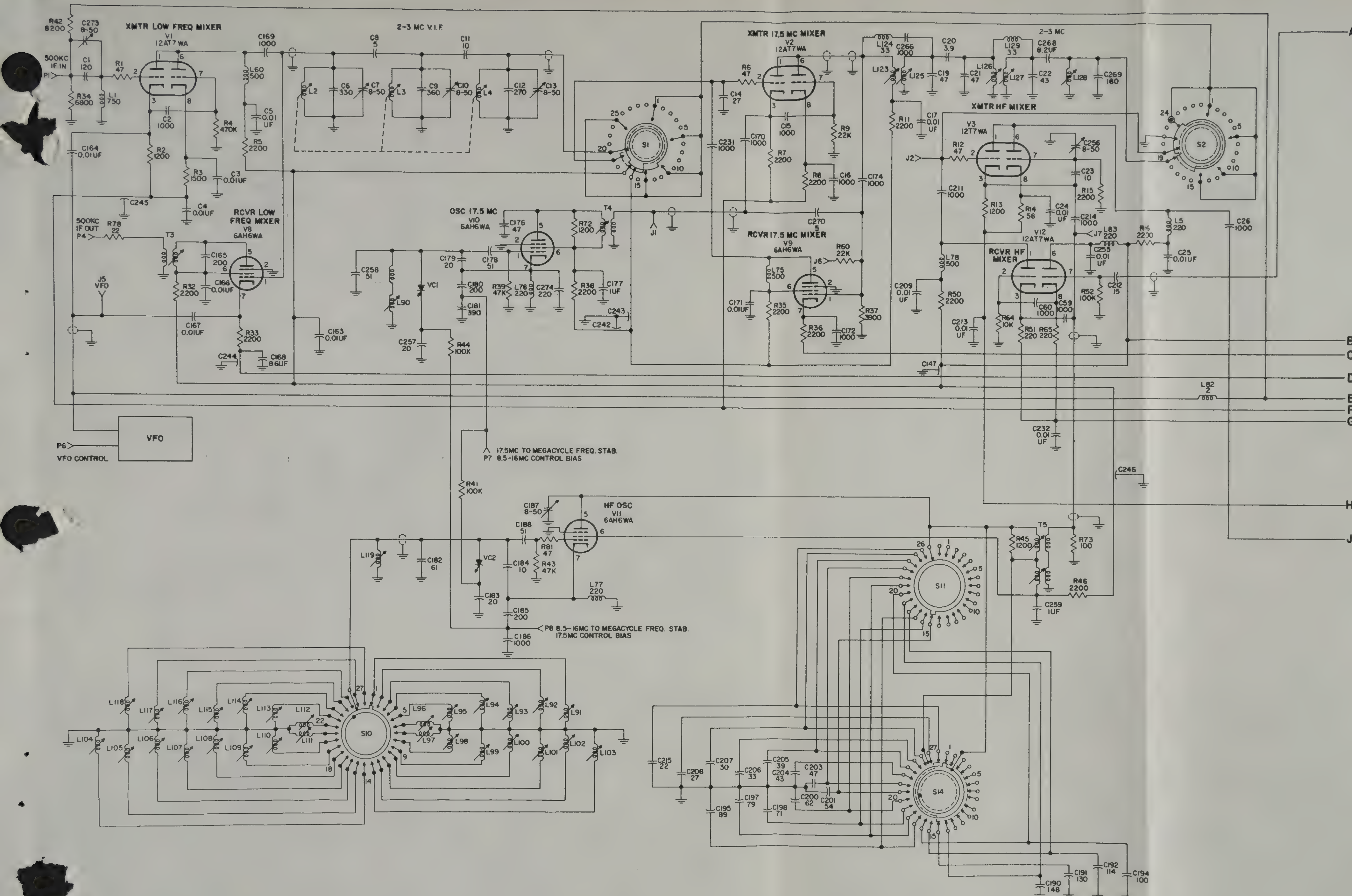
Module (Early Model),
ram (Sheet 1 of 3)
re 1122



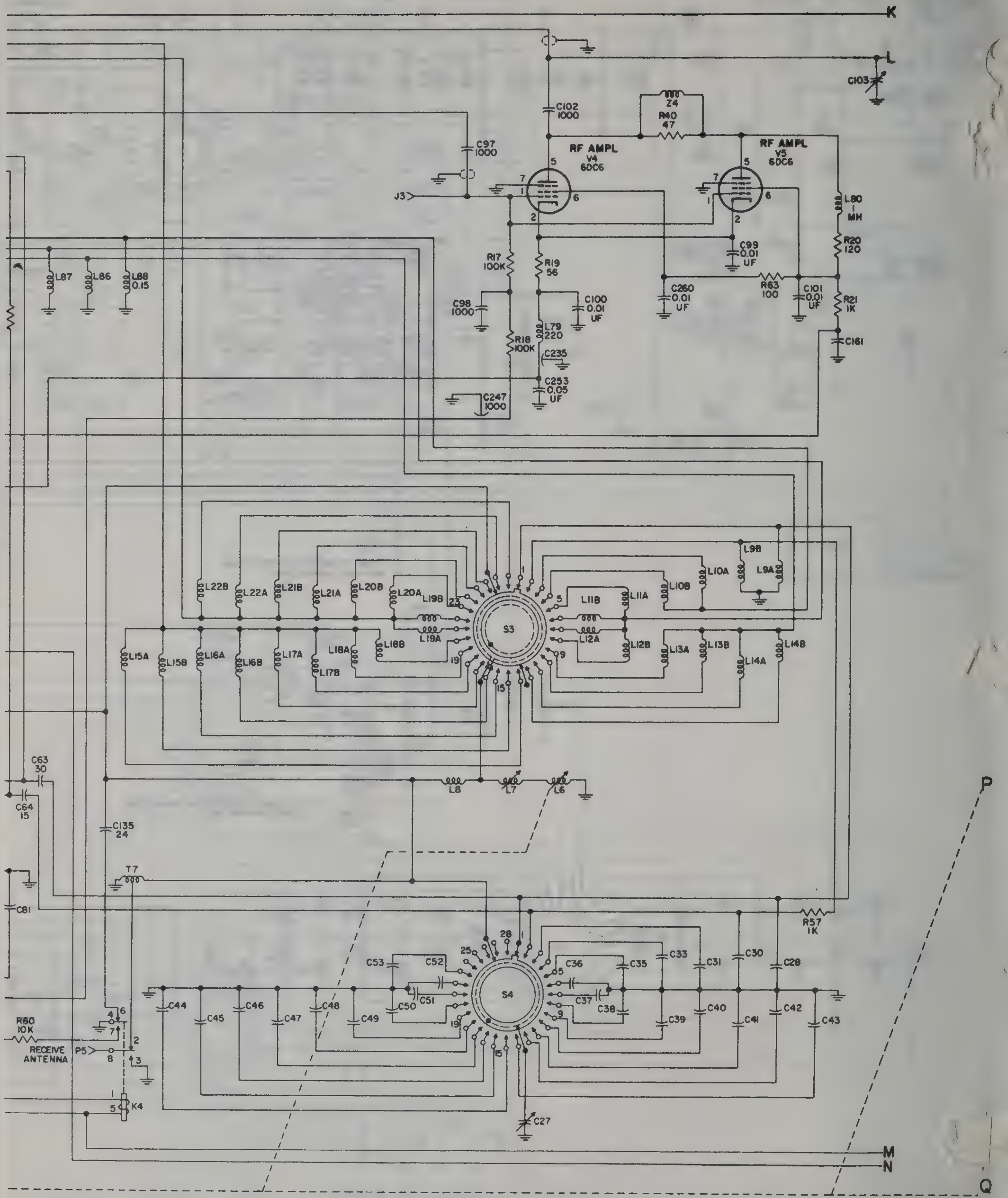
NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROMICROFARADS, AND INDUCTANCE VALUES ARE IN MICROHENRYS.
2. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH THE UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.

AM/Audio Amplifier Module (Early Model)
Schematic Diagram
Figure 1121

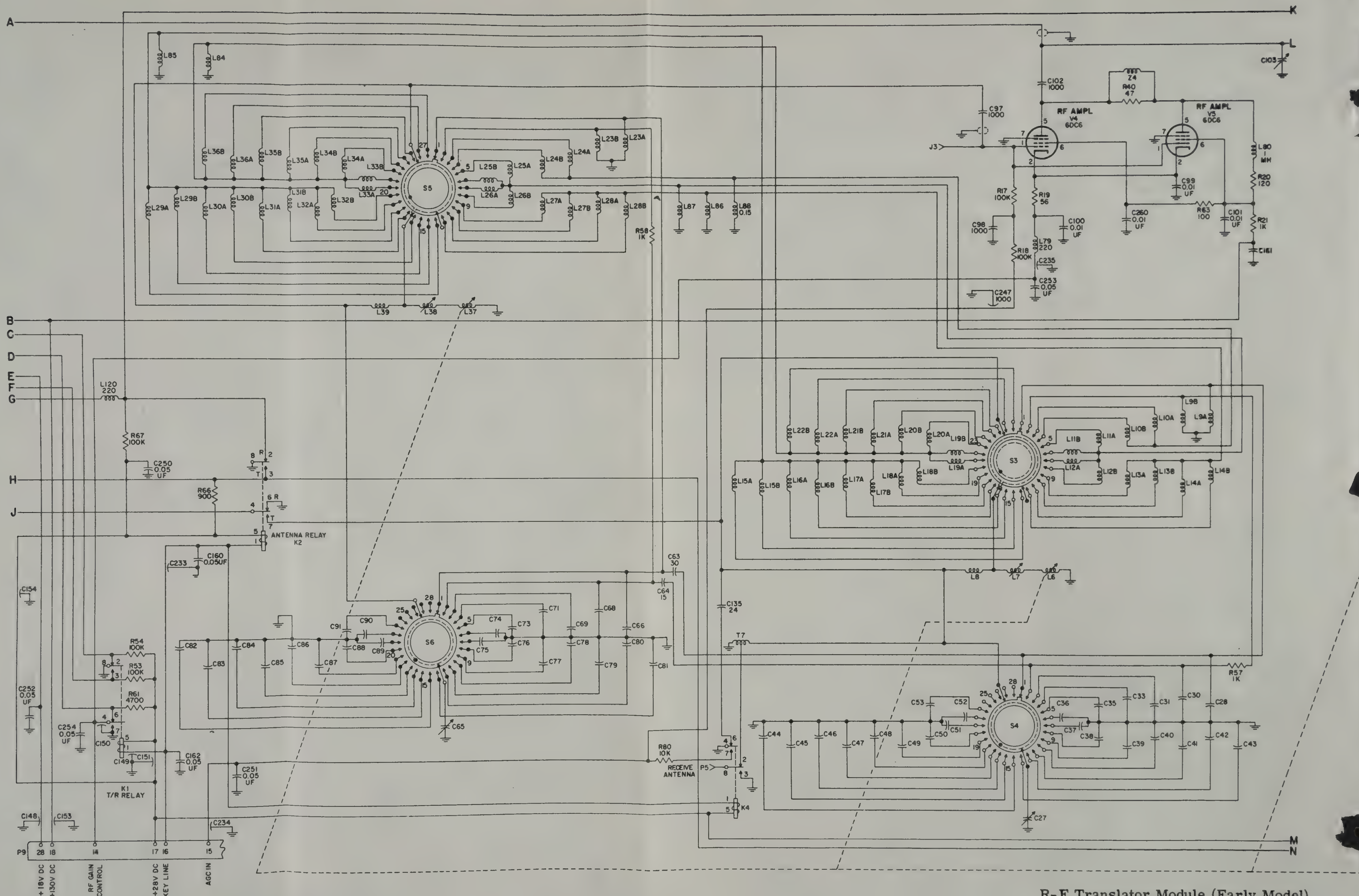


R-F Translator Module (Early Model), Schematic Diagram (Sheet 1 of 3)
Figure 1122

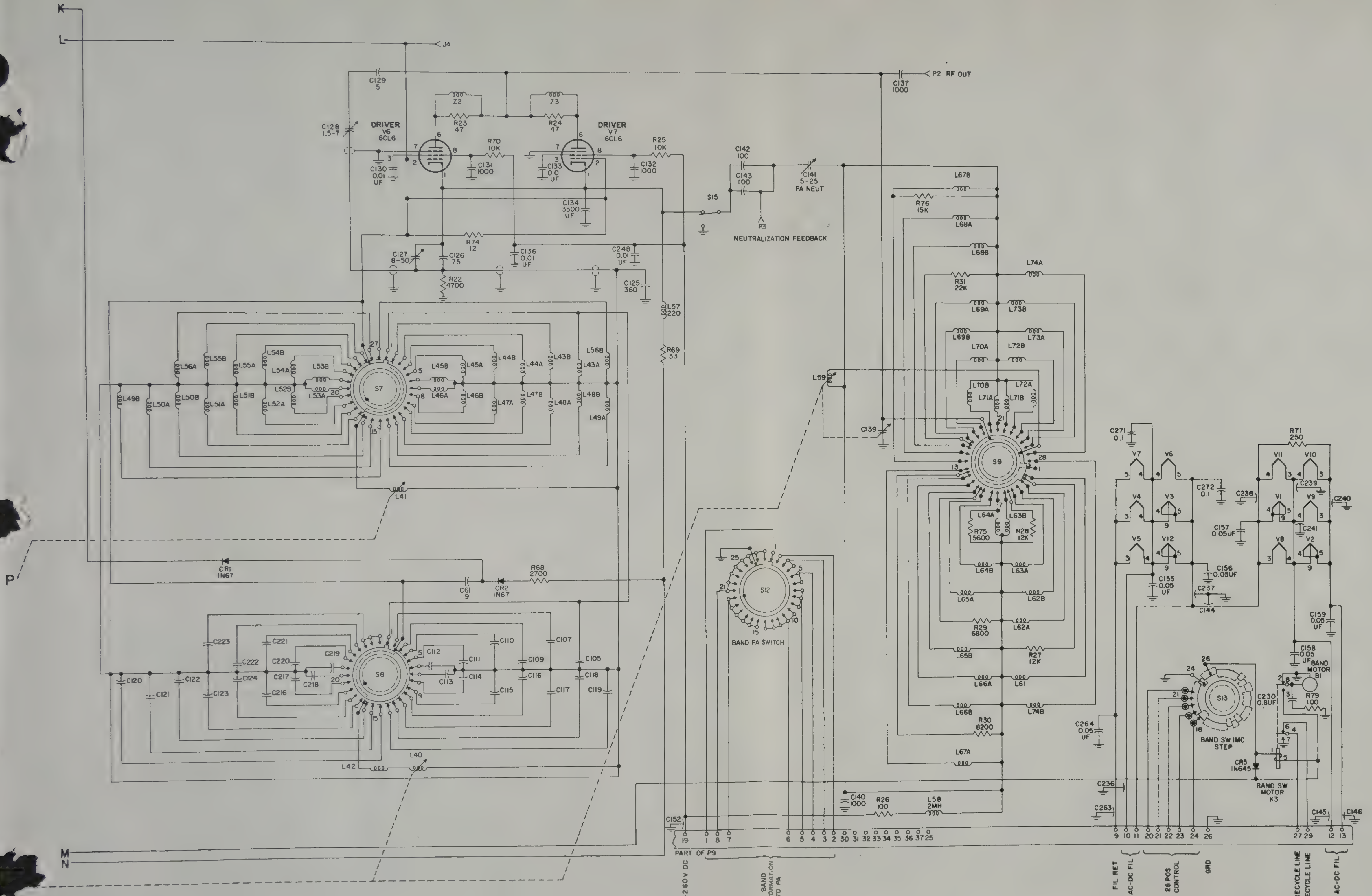


R-F Translator Module (Early Model), Schematic Diagram (Sheet 2 of 3)
Figure 1122

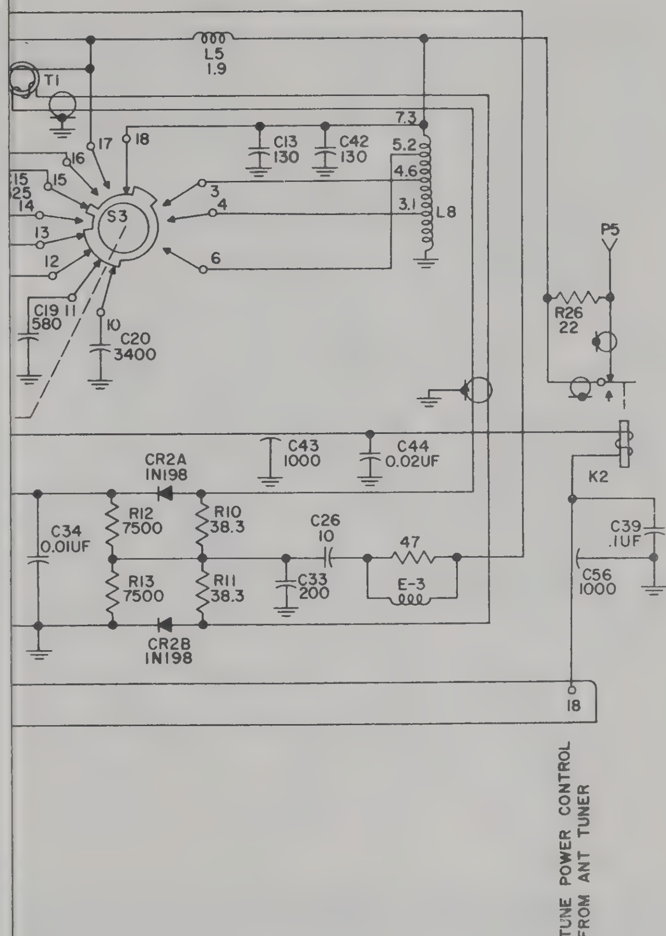
P



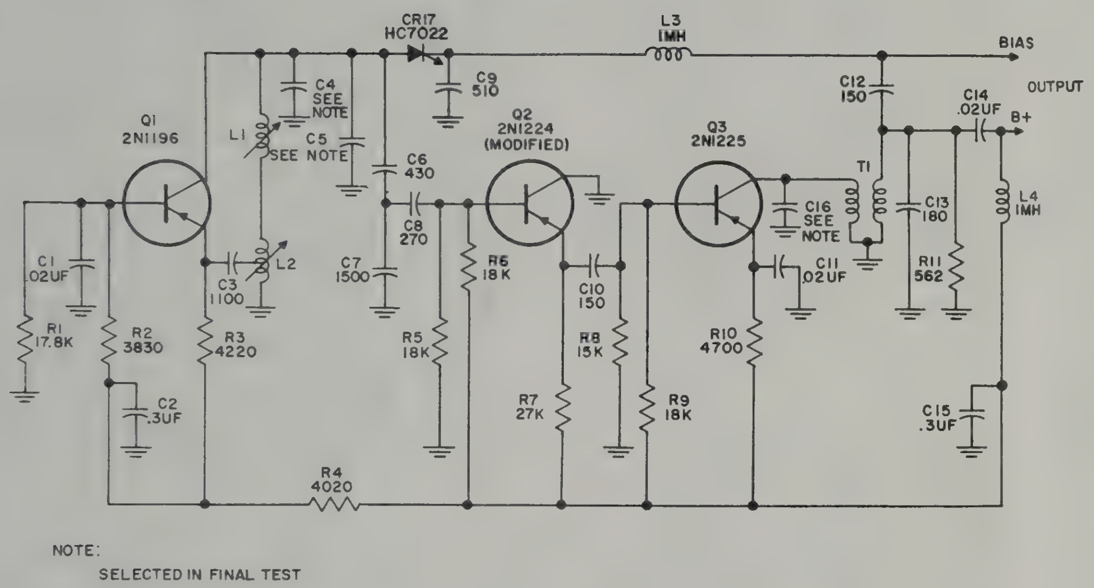
R-F Translator Module (Early Model), Schematic Diagram (Sheet 2 of 3)
Figure 1122



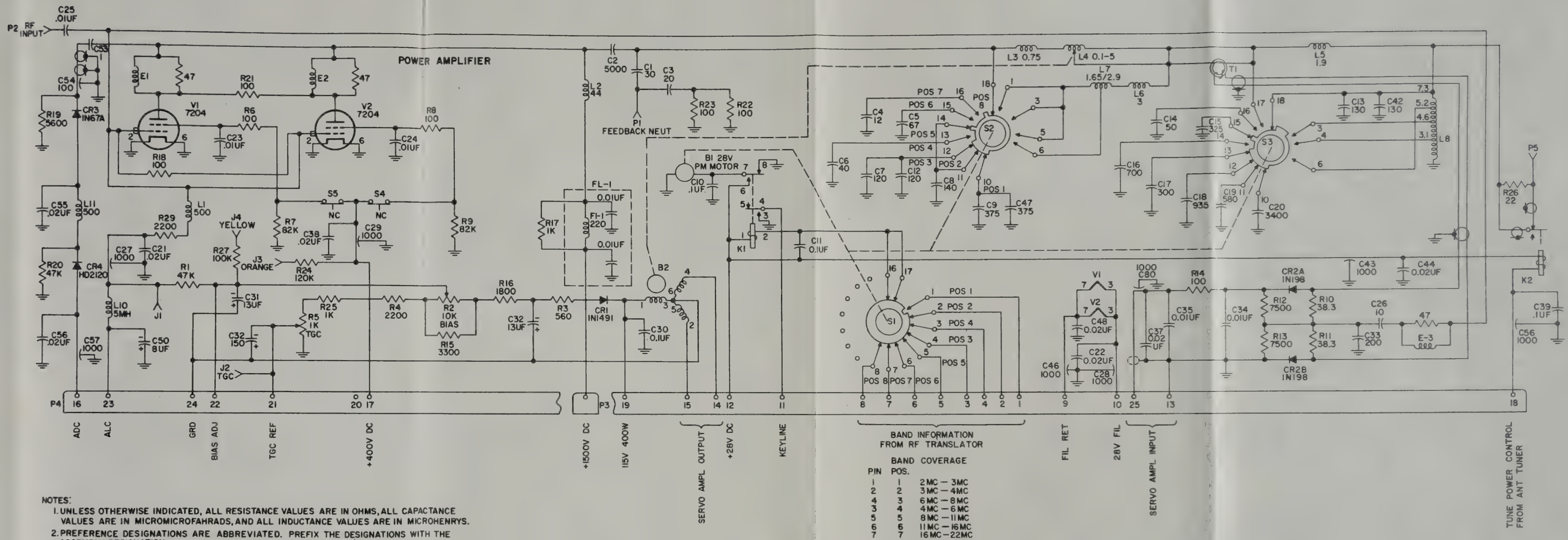
R-F Translator Module (Early Model),
Schematic Diagram (Sheet 3 of 3)
Figure 1122



e (Early Model), Schematic Diagram
Figure 1124



VFO Submodule, Model 70K-3, Schematic Diagram
Figure 1123



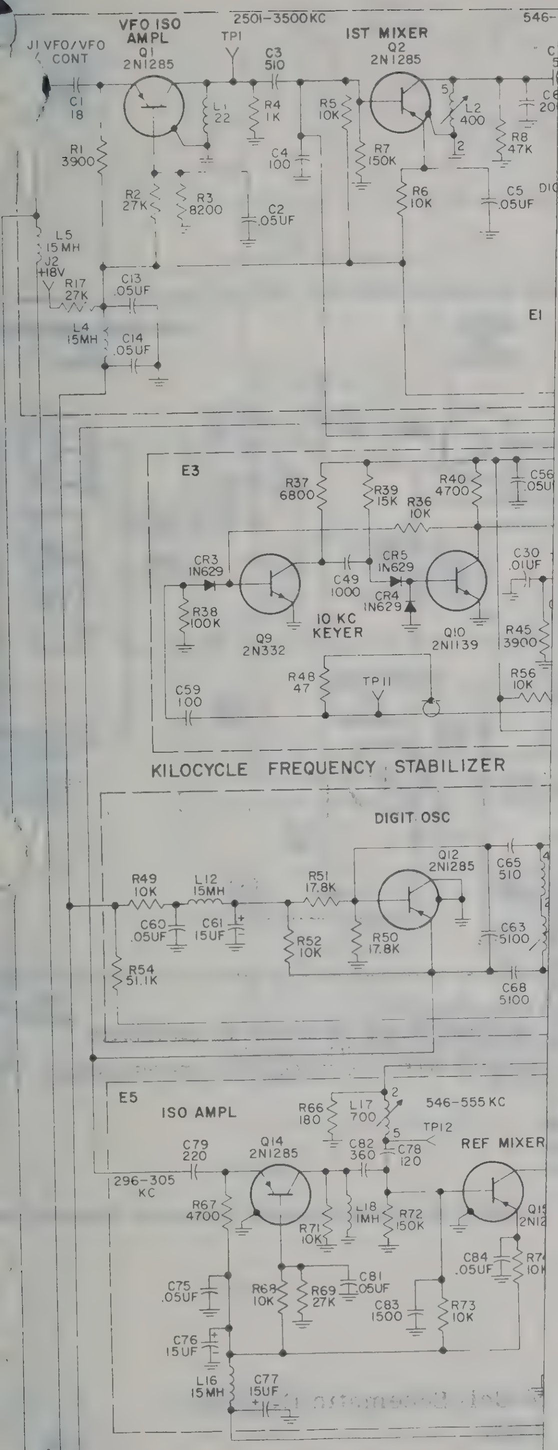
NOTES:

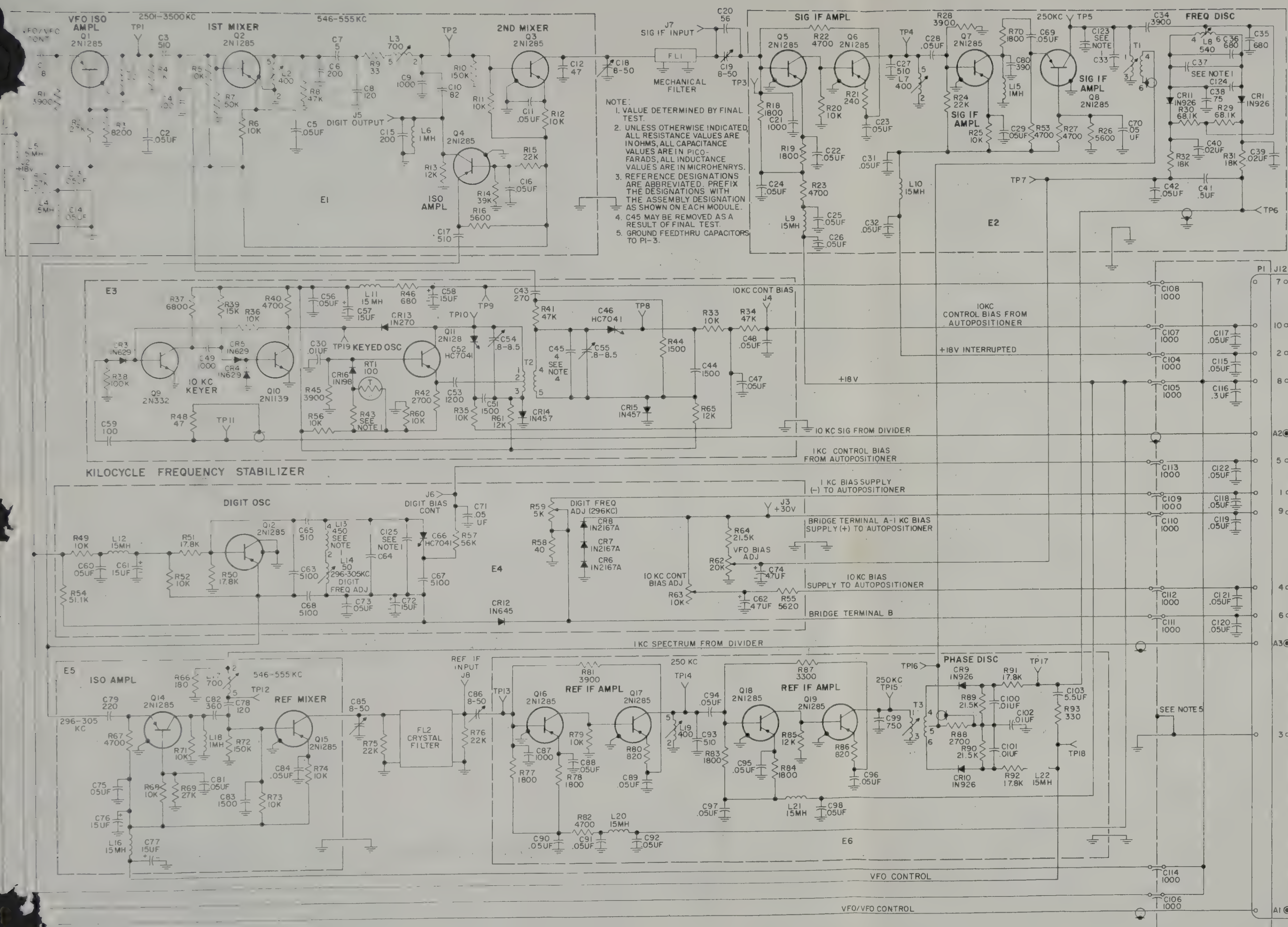
1. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACTANCE VALUES ARE IN MICROMICROFAHRADS, AND ALL INDUCTANCE VALUES ARE IN MICROHENRYS.
2. PREFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH THE ASSEMBLY DESIGNATION.

BAND COVERAGE

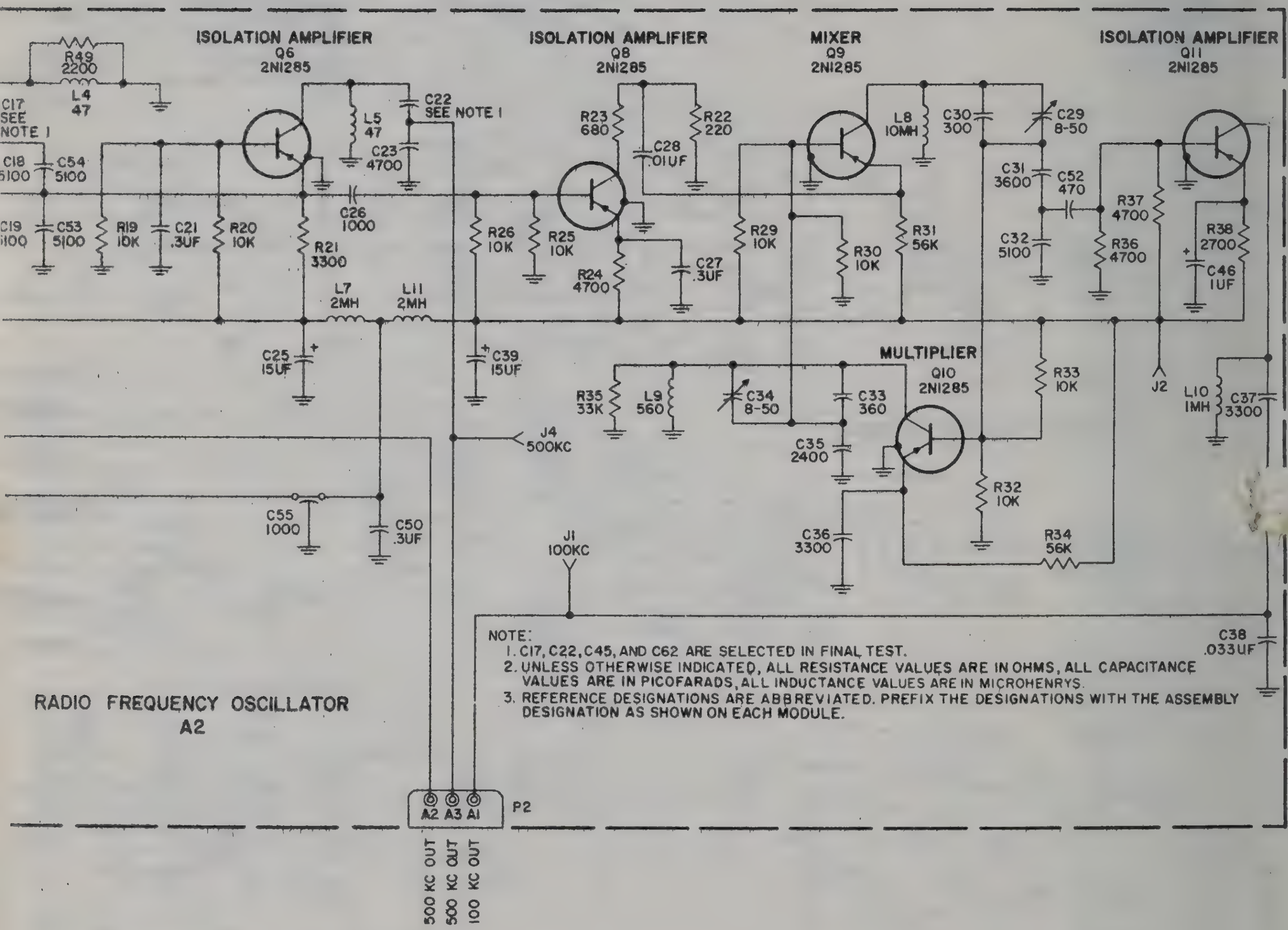
PIN	POS.	
1	1	2MC — 3MC
2	2	3MC — 4MC
4	3	6MC — 8MC
3	4	4MC — 6MC
5	5	8MC — 11MC
6	6	11MC — 16MC
7	7	16MC — 22MC
8	8	22MC — 30MC

Power Amplifier Module (Early Model), Schematic Diagram
Figure 1124

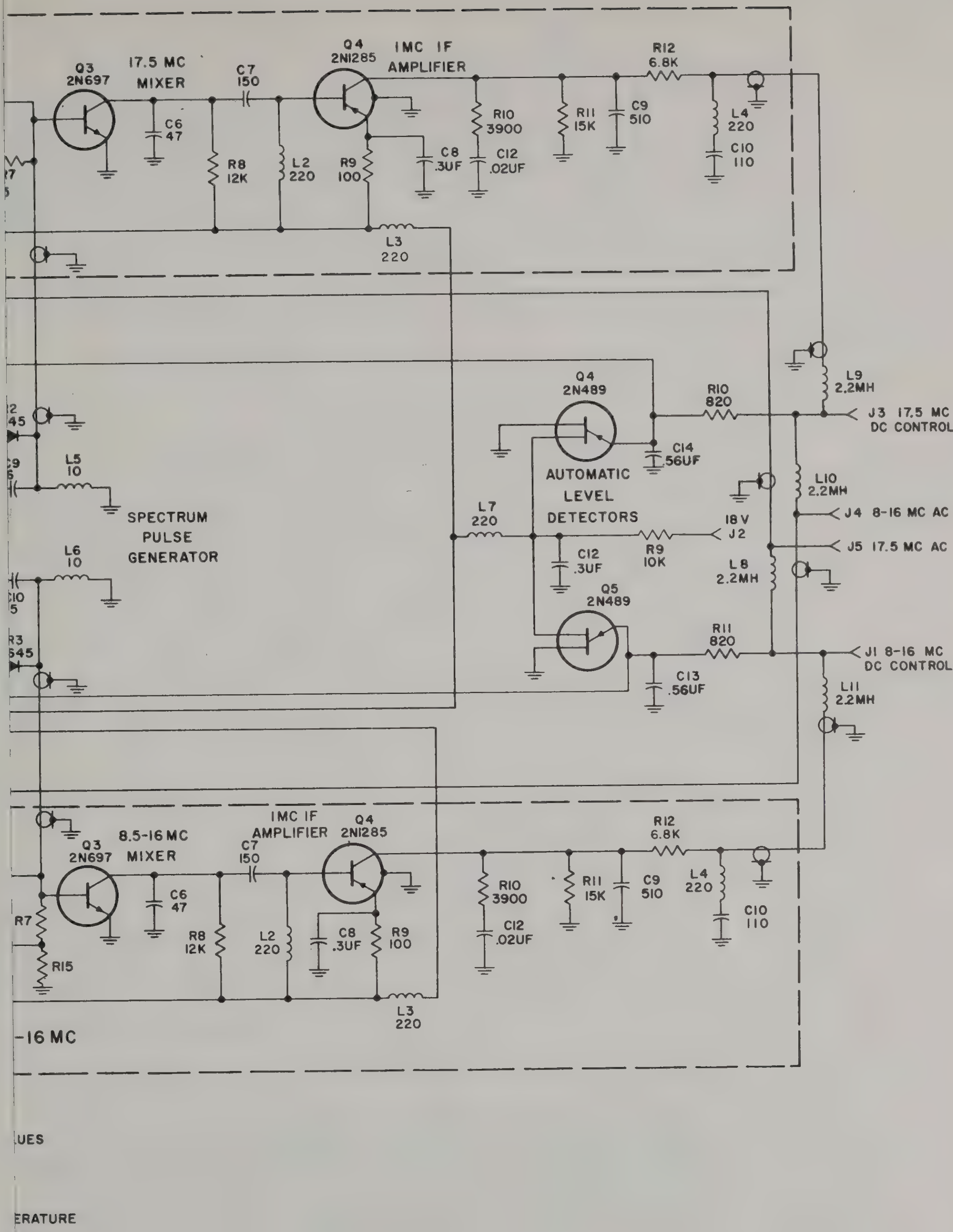

VFO ISO AMPL
Q1 2N1285
2501–3500 KC
TP1
IST MIXER
Q2 2N1285
J1 VFO/VFO CONT
C1 18
C3 510
L1 22
R4 1K
R5 10K
L2 400
R8 47K
R1 3900
C4 100
R7 150K
R2 27K
R3 8200
C2 .05UF
R6 10K
C5 .05UF
L5 15MH
J2 +18V
R17 27K
C13 .05UF
L4 15MH
C14 .05UF
E1
E3
R37 6800
R39 15K
R36 10K
R40 4700
CR3 1N629
C49 1000
CR5 1N629
CR4 1N629
C30 .01UF
R38 100K
Q9 2N332
10 KC KEYER
Q10 2N1139
R45 3900
R48 47
TP11
R56 10K
C59 100
KILOCYCLE FREQUENCY STABILIZER
DIGIT OSC
Q12 2N1285
C65 510
R49 10K
L12 15MH
R51 17.8K
C60 .05UF
C61 15UF
R52 10K
R50 17.8K
C63 5100
R54 51.1K
C68 5100
E5
ISO AMPL
R66 180
L17 700
546–555 KC
TP12
C79 220
Q14 2N1285
C82 360
C78 120
REF MIXER
296–305 KC
R67 4700
L18 1MH
R72 150K
R71 10K
C84 .05UF
C75 .05UF
R68 10K
R69 27K
C81 .05UF
C83 1500
R73 10K
C76 15UF
L16 15MH
C77 15UF



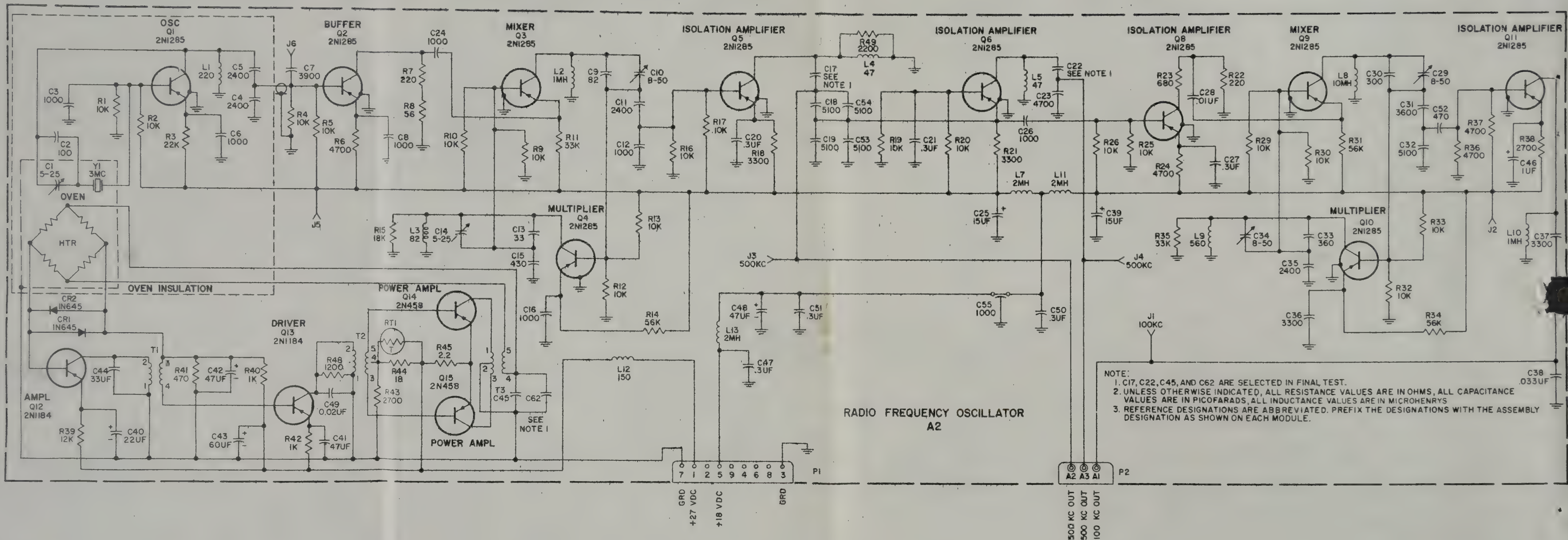
Kilocycle-Frequency Stabilizer Module
(Early Model), Schematic Diagram
Figure 1125



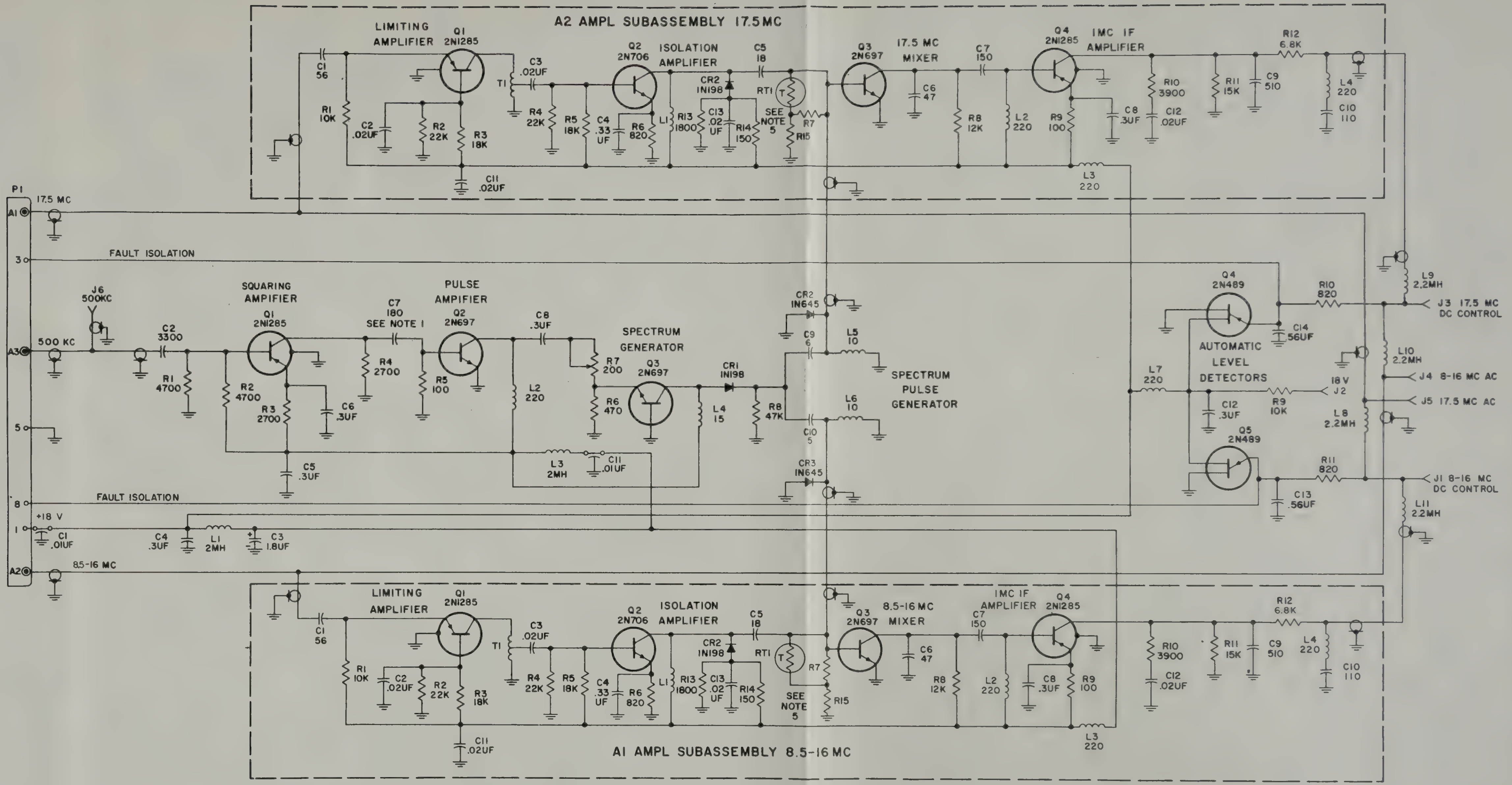
R-F Oscillator Module (Early Model) Schematic Diagram
Figure 1126



Megacycle-Frequency Stabilizer Module
(Early Model), Schematic Diagram
Figure 1127



R-F Oscillator Module (Early Model) Schematic Diagram
Figure 1126



NOTES:
1. NOMINAL VALUE; PROPER VALUE SELECTED DURING TEST.
2. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN PICOFARADS, AND ALL INDUCTANCE VALUES ARE IN MICROHENRYS.
3. PREFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH THE ASSEMBLY DESIGNATION AS SHOWN ON EACH MODULE.
4. EARLIER SERIAL NUMBERED MODULES USE 2N1224 TRANSISTORS IN PLACE OF 2N1285.
5. THE NOMINAL VALUE OF THE SERIES PARALLEL COMBINATION OF RT1, R7 AND R15 AT ROOM TEMPERATURE IS 250 OHMS. PROPER VALUES SELECTED DURING TEST.

Megacycle-Frequency Stabilizer Module (Early Model), Schematic Diagram
Figure 1127

By Order of the Secretary of the Army:

EARLE G. WHEELER,
General, United States Army,
Chief of Staff.

Official:

J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

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